LIBRARY
FISH & WILDLIFE SERVICE
PACIFIC OCEANIC FISHERY
INVESTIGATIONS

SURVEY OF THE COLUMBIA RIVER AND ITS TRIBUTARIES - Part VII

SPECIAL SCIENTIFIC REPORT: FISHERIES No. 40

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

1551.8 4/2,45

Explanatory Note

The series embodies results of investigations, usually of restricted scope, intended to aid or direct management or utilization practices and as guides for administrative or legislative action. It is issued in limited quantities for the official use of Federal, State or cooperating agencies and in processed form for economy and to avoid delay in publication.

Washington, D. C.
November, 1950

United States Department of the Interior
Oscar L. Chapman, Secretary
Fish and Wildlife Service
Albert M. Day, Director

Special Scientific Report - Fisheries

No. 40

SURVEY OF THE COLUMBIA RIVER AND ITS TRIBUTARIES

PART 7

Area VI. Snake River from above the Grande Ronde River through the Payette River.

By

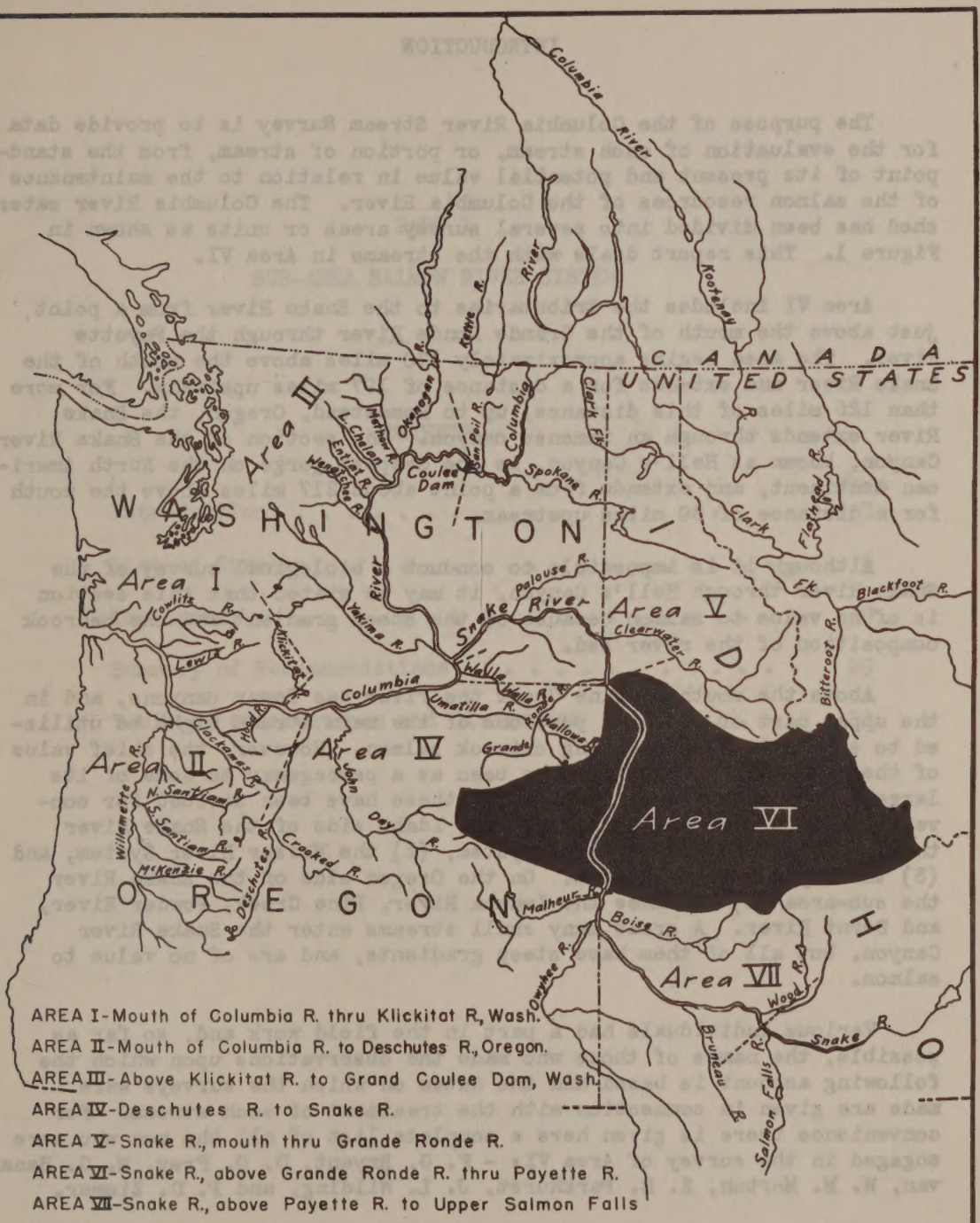
Zell E. Parkhurst
Fishery Research Biologist

CONTENTS

	Page
Introduction	2
Part 1. Sub-Area Salmon River System.	3
Introduction.	5
List of Streams	6
The Survey.	9
Table of Obstructions and Diversions.	30
Part 2. Sub-Area Weiser River System.	31
Introduction.	32
List of Streams	33
The Survey.	35
Table of Obstructions and Diversions.	44
Part 3. Payette River System	45
Introduction.	47
List of Streams	49
The Survey.	50
Table of Obstructions and Diversions.	60
Part 4. Exclusive of Sub-Areas	61
Introduction.	63
List of Streams	64
The Survey.	68
Table of Obstructions and Diversions.	92
Literature Cited	95

ILLUSTRATIONS

FIGURE		Page
1.	Columbia River System	1
2.	Clearwater, Salmon, and Weiser River Systems	4
3.	Confluence of main Salmon River and Middle Fork	13
4.	Confluence of Camas Creek and Middle Fork of Salmon River.	15
5.	Payette River System	46
6.	Black Canyon Dam	51
7.	North Fork of Payette River	53
8.	Area VI exclusive of Sub-Areas	62



AREA I-Mouth of Columbia R. thru Klickitat R, Wash.
AREA II-Mouth of Columbia R. to Deschutes R., Oregon.
AREA III-Above Klickitat R. to Grand Coulee Dam, Wash.
AREA IV-Deschutes R. to Snake R.
AREA V-Snake R., mouth thru Grande Ronde R.
AREA VI-Snake R., above Grande Ronde R. thru Payette R.
AREA VII-Snake R., above Payette R. to Upper Salmon Falls

COLUMBIA RIVER SYSTEM

SCALE

40 20 0 50 100
50 30 10 25 75 125 MILES

Figure 1

INTRODUCTION

The purpose of the Columbia River Stream Survey is to provide data for the evaluation of each stream, or portion of stream, from the standpoint of its present and potential value in relation to the maintenance of the salmon resources of the Columbia River. The Columbia River watershed has been divided into several survey areas or units as shown in Figure 1. This report deals with the streams in Area VI.

Area VI includes the tributaries to the Snake River from a point just above the mouth of the Grande Ronde River through the Payette River. The area begins approximately 170 miles above the mouth of the Snake River and extends for a distance of 197 miles upstream. For more than 125 miles of this distance, up to Homestead, Oregon, the Snake River extends through an immense canyon. One section of the Snake River Canyon, known as Hell's Canyon, is the deepest gorge on the North American continent, and extends from a point about 217 miles above the mouth for a distance of 30 miles upstream.

Although it is impossible to conduct a biological survey of the Snake River through Hell's Canyon, it may be stated that this section is of no value to salmon because of the steep gradient and the bedrock composition of the river bed.

Above the mouth of Pine Creek the river has fewer canyons, and in the upper part of the area portions of the main stream might be utilized to some extent by spawning chinook salmon. However, the chief value of the Snake River to salmon has been as a passageway to some of its large tributary systems. In Area VI these have been divided for convenience into four sub-areas. On the Idaho side of the Snake River these are (1) the Salmon River System, (2) the Weiser River System, and (3) the Payette River System. On the Oregon side of the Snake River the sub-area (4) includes the Immaha River, Pine Creek, Powder River, and Burnt River. A great many small streams enter the Snake River Canyon, but all of them have steep gradients, and are of no value to salmon.

Various individuals had a part in the field work and, so far as possible, the names of those who made the observations upon which the following account is based and the dates on which the surveys were made are given in connection with the treatment of each stream. For convenience there is given here a complete list of all the men who were engaged in the survey of Area VI: - F. G. Bryant, D. G. Frey, M. G. Hanavan, W. M. Morton, Z. E. Parkhurst, J. L. Wilding, and P. D. Zimmer.

PART 1

SUB-AREA SALMON RIVER SYSTEM

CONTENTS

	Page
Introduction	5
List of Streams	6
The Survey	9
Summary of Recommendations	29
Table of Obstructions and Diversions	30

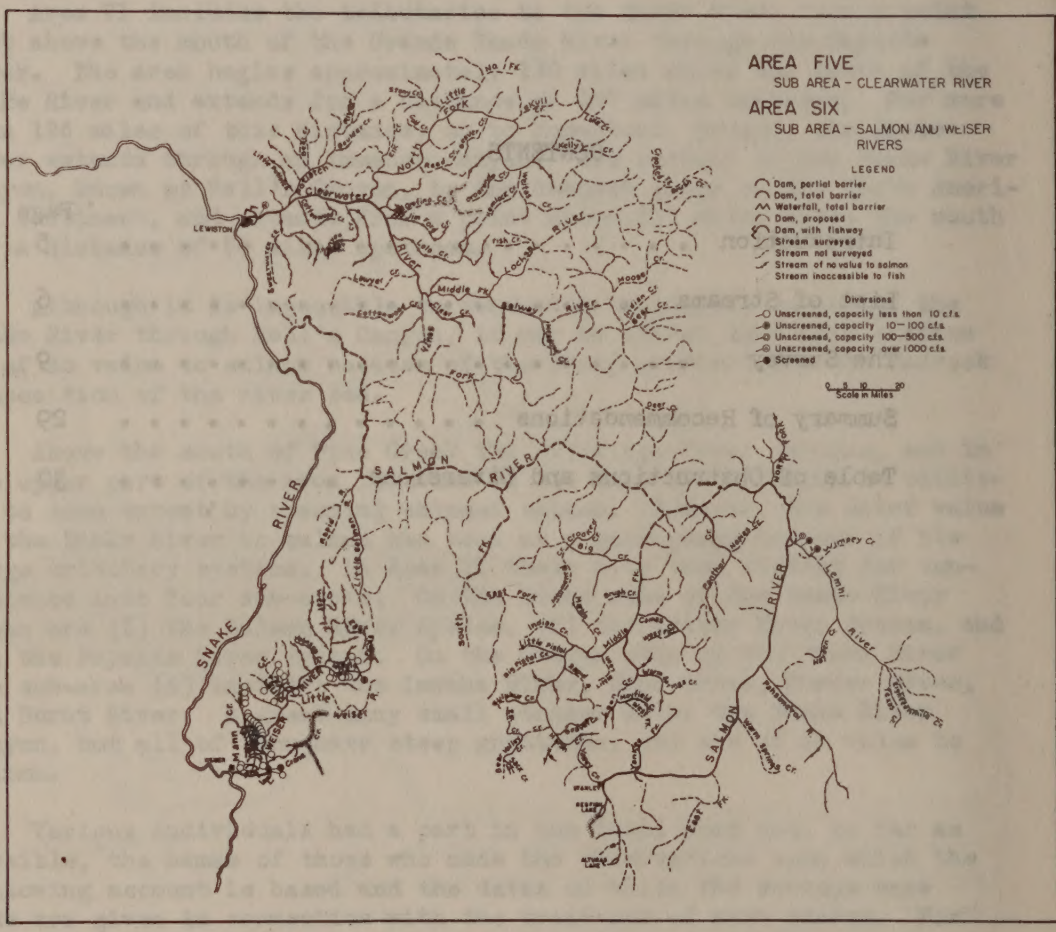


Figure 2. Clearwater, Salmon, and Weiser River Systems

Introduction

The Salmon River joins the Snake River approximately 187 miles above the Columbia River confluence. Its drainage area comprises more than 14,000 square miles of central Idaho, and includes a considerable portion of the Sawtooth Mountains, as well as the southwestern slope of the Bitterroot Mountains, which also form the boundary of the Pacific Slope. The total stream length of the Salmon River system, excluding all minor tributaries, amounts to more than 1200 miles.

The Salmon River system always has been one of the mainstays in the production of the choice early variety or spring chinook salmon. Some of the lakes in its headwaters also have contributed to the production of the valuable blueback salmon. In recent years it has assumed added importance because of the industrial and agricultural development of other watersheds formerly of major value as salmon spawning areas and the consequent loss of these regions as salmon producing areas. A considerable part of the system is of value from the standpoint of natural salmon production because it is unmolested by man due to the extremely rugged topography of the watershed, and will probably always remain in its present primitive condition. On the other hand, the present chinook and blueback salmon runs in the easily accessible headwaters area are only a small fraction of their former size. The value of this river system to anadromous fish will be further reduced if the proposed series of major dams in the Middle Columbia and lower Snake Rivers is constructed.

The vanguard of the chinook run appears in the upper Salmon River early in June, and spawning occurs in July and August. Inasmuch as the commercial fishing season in the lower Columbia in past years has not begun until May 1, the majority of these fish have passed through the commercial fishery by that date and have not been subjected to it on their spawning migration. The effect of the marine fishery during the several years of ocean residence is of course unknown for any particular stock of salmon.

The bluebacks in the Salmon River system spawn in October, considerably later than the chinooks. These fish are subjected to an intense commercial fishery in the lower Columbia River.

A survey of the Salmon River system was undertaken in June and July, 1941. At that time the main Salmon River was very turbid, and for this reason the detailed survey was confined to the larger clear tributaries, except for part of the clear headwaters portion of the main stream above Stanley, Idaho.

List of Streams

	Page
1. Main Salmon River	9
A. Little Salmon River	11
(1) Rapid River	11
a. West Fork	11
B. South Fork, Salmon River	11
(1) Secesh River	11
(2) East Fork	11
a. Johnson Creek	11
C. Middle Fork, Salmon River	11
(1) Big Creek	14
a. Monumental Creek	14
b. Crooked Creek	14
(2) Camas Creek	14
a. West Fork	14
(3) Loon Creek	16
a. Rock Creek	16
b. Warm Spring Creek	16
i. Trapper Creek	16
c. Mayfield Creek	17
i. West Fork	17
ii. East Fork	17
d. Trail Creek	18
e. Pioneer Creek	18

List of Streams (continued)

	Page
(4) Little Loon Creek	18
(5) Marble Creek	18
(6) Indian Creek	19
(7) Pistol Creek	19
a. Big Pistol Creek	20
b. Little Pistol Creek	20
(8) Rapid River	20
(9) Soldier Creek	21
(10) Elkhorn Creek	21
(11) Sulphur Creek	21
(12) Marsh Creek	22
a. Beaver Creek	22
b. Cape Horn Creek	22
i. Banner Creek	23
c. Knapp Creek	23
(13) Bear Valley Creek	23
a. Elk Creek	24
b. Sack Creek	24
c. Cache Creek	24
D. Panther Creek	25
(1) Napias Creek	25
E. North Fork, Salmon River	26
F. Lemhi River	26

List of Streams (continued)

Page

(1) Wimpey Creek 27

(2) Hayden Creek 27

(3) Canyon Creek 27

(4) Eighteenmile Creek 27

(5) Texas Creek 27

G. Pahsimeroi River 27

H. East Fork, Salmon River 28

I. Yankee Fork, Salmon River 28

J. Valley Creek 28

K. Redfish Lake Creek 28

The Survey

1. Main Salmon River.-- (July 20-23, 1941; Bryant). The main Salmon extends for approximately 400 miles. In the lower 200 miles it flows through the second deepest canyon on the North American continent. This part of the river has a fairly steep gradient and little suitable spawning area. The upper terminus of the canyon is near Shoup, Idaho.

The stream gradient is moderate above the canyon, and a large amount of spawning area was found. The stream bed was heavily silted for a distance of approximately 161 miles from Shoup to Stanley, and many otherwise good spawning riffles in this area were considered of doubtful value for the development of salmon eggs. This condition was due to mining operations, the principal source of silting being a large gold dredge operating on Yankee Fork, although there were other dredges and mines on both the main stream and some of its tributaries which were contributing to this condition. Among these were the mine on the North Fork near Gibbonsville, the silver mine at Clayton on the main Salmon, and the operations on Valley Creek near Stanley.

The effects of turbid water and a heavily silted stream bed on the migration and spawning activities of salmon have not been agreed upon by all fisheries investigators. Many instances are recorded where salmon migrate through very turbid water with apparently no ill effects. Salmon often have been observed spawning in silted streams, and their spawning activity has the effect of washing the gravel and making the nests easily distinguishable from the remainder of the stream bed. The subsequent silting of the nests however, may be very harmful to the development of the eggs, depending in large measure on the extent to which it occurs. This has been well demonstrated by Hobbs (1937), Shapovalov and Berrian (1940), Smith (1940), and others. In the Salmon River, silting has been so extensive as to constitute a serious hazard in the development of salmon eggs. There is no practical remedy for this condition.

There is excellent spawning area, free of pollution, for a distance of about 35 miles above Stanley. There are numerous small side channels in this area where flows of 5-6 c.f.s. are maintained by constant cold springs, and which serve as perfect natural rearing places for salmonoid fry. This area with its tributaries at present supports small, greatly depleted runs of chinook and blueback salmon and a fair spring run of steelhead trout. There are several tributary lakes in the headwaters that offer suitable habitats for blueback salmon. These include Alturas, Pettit, Yellow Belly, Little Redfish, and Big Redfish Lakes, all of which were studied by Evermann (1895, 1896, 1897). The main Salmon River was

surveyed July 20-25, 1941, for a distance of 19 miles, from Stanley to the Sawtooth Valley ranger station. The river was 120 feet wide and flowing about 375 c.f.s. at Stanley. At the upper terminus of the survey it was 66 feet wide and the flow had decreased to about 225 c.f.s. The gradient is moderate, with numerous good shallow riffles and adequate resting pools. There are 160,000 square yards of suitable spawning area, constituting approximately 21 percent of the total bottom in the portion surveyed. A search was made for blueback salmon in the Redfish Lakes region during the early part of October, 1942. About 200 of these fish were found spawning in Big Redfish Lake, and none in the other lakes.

The headwaters of the Salmon River system are easily accessible from nearby roads, and the custom of spearing salmon on the spawning beds, although the fish are in poor condition for food, formerly resulted in great economic waste and has been one of the principal causes of salmon depletion in this region. The regulation abolishing the spearing and snagging of salmon and steelhead trout, placed in effect by the Idaho Fish and Game Commission in 1945, has been of great benefit.

The Sunbeam Dam, located just above the confluence of Yankee Fork, or approximately 360 miles above the mouth, has been another important factor contributing to the depletion of salmon in the headwaters. It was reported that this dam was built in 1913, and stood unused for many years. It was of concrete construction, about 30 feet high, and constituted a partial barrier to salmon. Attempts to construct a fishway never were satisfactory. Steelhead were able to ascend the fishway during spring high water, but at the time of arrival of the chinook and blueback runs in late summer and early fall the river was too low to enable the fish to enter the ladder. A few fish at times succeeded in passing through a tunnel around one side of the dam. Although this dam interfered with the utilization of a large amount of excellent chinook spawning area, it was especially damaging to the blueback run, which is entirely dependent upon access to the lakes above. Sunbeam Dam was partially removed in 1934, and although no longer such a serious obstacle, chinook and blueback salmon still congregate in the pool below the remnants of the dam, where an intense so-called sport fishery is prosecuted against them.

The only other dams noted were several small, temporary, irrigation wing dams above Stanley, none of which was a barrier to the upstream migration of salmon.

There are no important water diversions on the main Salmon River. Three small, unscreened irrigation ditches were in operation above Stanley, none withdrawing more than 5 c.f.s.

There are no fish hatcheries on the main Salmon River. Chinook salmon fry and fingerlings were formerly released into the stream by the U. S. Fisheries Station at Salmon, Idaho, as a result of fish-cultural activities on the Lemhi River. No salmon have been propagated at this station in recent years.

1A. Little Salmon River.-- (October 9, 1942; Parkhurst and Bryant.) The Little Salmon River enters the main Salmon River at Riggins, Idaho, approximately 82 miles above the mouth. It is about 43 miles long, of which the lower 34 miles were surveyed. Near the mouth the stream had an average width of about 50 feet. The discharge was 210 c.f.s. and the water temperature was 54.5° F. The lower 24 miles has a fairly steep gradient in many places and a large amount of bedrock and large rubble. Good spawning area is not extensive. In the upper 10 miles of the section surveyed the stream has a slight gradient and a large amount of mud and sand. There were 76,000 square yards of suitable spawning area, constituting approximately 9 percent of the total bottom in the portion surveyed. No total barriers to fish were found, but several small falls and cascades render the upper section difficult of access to salmon during low-water stages. No salmon were seen during the survey, and it was reported that none had been seen spawning in the Little Salmon for several years. The stream formerly supported a fair run of chinook salmon. It is easily accessible, and the fish were formerly subjected to an intensive sport fishery. It is of little or no value as a salmon producer at present, but has some potential value.

1A-(1), Rapid River.-- (Not surveyed) Rapid River enters the Little Salmon River approximately 4 miles above the mouth. The stream is about 21 miles long, and was discharging about 25 c.f.s. Its principal tributary is 1A-(1)a, the West Fork, about 9 miles long. Rapid River was reported to support a small run of chinook salmon.

1B. South Fork, Salmon River.-- (Not surveyed) The South Fork enters the Salmon River approximately 129 miles above the mouth. It is about 80 miles long. Gaging-station records for the water-year 1940-1941 (U.S.G.S., 1942) give the mean discharge as 1,508 c.f.s. at a point about 20 miles above the mouth. The principal tributaries are 1B-(1), the Secesh River, entering approximately 34 miles above the mouth and extending about 22 miles, and 1B-(2), the East Fork, entering approximately 35 miles above the mouth, and together with 1B-(2)a, Johnson Creek, extending about 60 miles. The East Fork was reported to be often turbid from mining silt below Stibnite, Idaho, approximately 26 miles above the confluence with the South Fork. The South Fork is difficult of access, and a large part of the watershed is seldom frequented. The stream is known to have formerly supported large runs of chinook salmon and steelhead. The present condition of these runs has not been determined, but it is reported that they still occur to some extent.

1C. Middle Fork, Salmon River.-- (June 20-July 24, 1941; Parkhurst, Zimmer, Frey, and Bryant.) The Middle Fork enters the Salmon River approximately 191 miles above the mouth. The stream is about 106 miles long, of which the upper 88 miles and all the major tributaries were surveyed. It is the largest and most important tributary to the main Salmon River. Gaging-station records for the water-year 1938-39 (U.S.G.S., 1940) gives the mean discharge as 1,484 c.f.s. at a point about 30 miles above the mouth. The stream width decreased from about 200 feet near the mouth to 75 feet at the confluence of Bear Valley and Marsh Creeks, which is considered the point of origin.

The stream is not easily accessible except by boat from the mouth to the confluence of Big Creek, 18 miles above. In this section the course extends through a narrow bedrock canyon, and offers practically no suitable spawning area. The tributaries in this lowermost section are small, have very steep gradients, and are of no value to salmon.

The gradient is moderate throughout most of the course, having a rise of 21-22 feet per mile between the confluence of Big Creek and the confluence of Camas Creek, 17 miles above, and gradually increasing upstream until it has a rise of slightly more than 50 feet per mile in the uppermost 10 miles.

The best appearing spawning area was found between Big Creek and Camas Creek. The entire stream has many extensive shallow riffle areas, but the bottom is composed mainly of rubble that is too large to be of best use to spawning salmon. There were 380,000 square yards of suitable spawning area, constituting approximately 5 percent of the total bottom in the portion surveyed.

The only obstacle to migratory fish on the Middle Fork is Sulphur Creek Falls, located approximately 96 miles above the mouth, or about $2\frac{1}{2}$ miles above the confluence of Sulphur Creek. This consists of two cascades, neither having a fall of more than 8 feet. They are located in a narrow box canyon, and are passable with difficulty at high water, due to the velocity of the confined flow in the narrow, rocky channel. Salmon and steelhead trout have always spawned above this point, however, and the falls cannot be considered a barrier.

The chinook run reaches the Middle Fork in June, and spawning is usually completed late in July or early in August. A large portion of the fish entering the Middle Fork apparently utilize it chiefly for its large resting pools, and when spawning time approaches ascend the principal tributaries, where the best spawning beds are located. Very few salmon had moved out of the resting pools and onto the spawning beds at the time of the survey, and consequently only a few were seen, as the water was slightly turbid from continued rains, and visibility was poor in the deep pools. In the lower part of the surveyed portion of the stream there is a fairly good run of chinooks into the larger tributaries through Camas Creek, 35 miles above the mouth. In the headwaters, where several excellent spawning streams flow together to form the Middle Fork, the salmon population has been badly depleted. The run was very small in this upper section in 1941, and was reported by both the U.S. Forest Service personnel and private guides to have been progressively smaller for a number of years previously. The headwaters are only a short distance from Stanley, Idaho, and are easily accessible to sport fishermen, who formerly took salmon on the spawning grounds. Because most of its course and many of its tributaries are seldom frequented by man, the Middle Fork as a whole is still of value as a salmon producer. However, it is capable of supporting many times its present salmon populations. A good run of steelhead trout appears in the river in April and May and ascends most of the tributaries. These fish have apparently suffered much less depletion than the chinook salmon.

Figure 3.-- Confluence of Middle Fork and Main Salmon River. Note turbidity of main stream.

1C-(1). Big Creek.-- (June 22-25, 1941; Parkhurst and Zimmer.) Big Creek enters the Middle Fork approximately 18 miles above the mouth. The stream is about 50 miles long, of which the lower 25 miles were surveyed. It is the largest and most important tributary to the Middle Fork. At the mouth the discharge was between 500 and 600 c.f.s. and the water temperature 54.0°F. At the upper terminus of the survey the flow was about 40 c.f.s. and the water temperature 46.5°F. The gradient is generally moderate, with extensive shallow riffles and numerous good resting pools. There were 480,000 square yards of suitable spawning area, constituting 35 percent of the total bottom in the portion surveyed. No obstructions or water diversions were encountered. The stream supports a fair run of chinook salmon and a good spring run of steelhead. It is difficult of access and suffers practically no molestation by man. The present chinook run does not approach the full spawning capacity of the stream.

1C-(1)a. Monumental Creek.-- (Not surveyed) Monumental Creek enters Big Creek approximately 25 miles above the mouth. The stream is about 25 miles long. It is the largest tributary to Big Creek, the two streams being almost equal size at their confluence. Monumental Creek was about 30 feet wide at the mouth and was discharging about 40 c.f.s. It was reported to support runs of chinook salmon and steelhead.

1C-(1)b. Crooked Creek.-- (June 26, 1941; Parkhurst and Zimmer.) Crooked Creek enters Big Creek approximately 25 miles above the mouth. The stream is about 15 miles long, and has a fairly steep gradient. It was discharging about 12 c.f.s. at the time of observation, and was very turbid from mining silt. There are numerous beaver dams in the stream, and it is of little value to salmon.

1C-(2). Camas Creek.-- (June 17-19, 1941; Parkhurst and Zimmer.) Camas Creek enters the Middle Fork approximately 35 miles above the mouth. The stream is about 38 miles long, of which the lower 19½ miles were surveyed. Near the mouth it was 70 ft. wide, discharging about 200 c.f.s., and the water temperature was 46.0°F. The gradient is fairly steep to moderate. There were 83,000 square yards of suitable spawning area, constituting approximately 17 percent of the total bottom in the portion surveyed. No obstructions or diversions were found. Camas Creek has a fair run of chinook salmon, and is capable of supporting a much larger run.

1C-(2)a. West Fork, Camas Creek.-- (July 12, 1941; Zimmer.) The West Fork enters Camas Creek approximately 15 miles above the mouth. The stream is about 13 miles long, of which the lower 6½ miles were surveyed. It is of little value to salmon above the upper terminus of the survey because of the steep gradient and slight volume of flow. Near the mouth the stream width was 20 ft. and the discharge about 50 c.f.s. The water temperature was 46.0°F. throughout. The gradient

Figure 4.-- Confluence of Camas Creek and Middle Fork of Salmon River.

is moderate in the lower part of the stream, where excellent spawning area is found. There were 38,000 square yards of suitable spawning area, constituting approximately 47 percent of the total bottom in the portion surveyed. An irrigation diversion dam located 2 miles above the mouth was not a barrier to fish. The unscreened ditch was estimated to carry 3-5 c.f.s. Several beaver dams found about 4 miles above the mouth were considered to be barriers at low water. The West Fork has a small run of chinook salmon, and could support a larger run.

1C-(3). Loon Creek.-- (June 20-30, 1941; Frey and Bryant.) Loon Creek enters the Middle Fork approximately 45½ miles above the mouth. The stream is about 34 miles long, of which the lower 26 miles were surveyed. Numerous beaver dams, the decreased volume of flow, and the steep gradient together rendered the stream of no value to salmon above the terminus of the survey. At the mouth it was 54 ft. wide, discharging about 550 c.f.s., and the water temperature was 51.0°F. The gradient is steep except for a section of moderate gradient extending 6½ miles, which contains most of the spawning area. There were 58,000 square yards of suitable spawning area, constituting approximately 8 percent of the total bottom in the portion surveyed. A small, unscreened irrigation ditch having a carrying capacity of about 3 c.f.s. was observed about 10 miles above the mouth. Loon Creek has a small run of chinook salmon, and could support a larger run.

1C-(3)a. Rock Creek.-- (June 26, 1941; Frey.) Rock Creek enters Loon Creek approximately 12 miles above the mouth. The stream is about 7 miles long, of which only the lower 400 yards were surveyed. Near the mouth it was 9 ft. wide and discharging about 15 c.f.s. The gradient is so steep that the stream was considered to be of no value to salmon.

1C-(3)b. Warm Spring Creek.-- (June 23-26, 1941; Frey and Bryant.) Warm Spring Creek enters Loon Creek approximately 14 miles above the mouth. The stream is about 17 miles long, of which the lower 11½ miles were surveyed. Beaver dams at the terminus of the survey were found to be so numerous and difficult to ascend that they were considered as barriers to salmon. Near the mouth the stream was about 30 ft. wide, discharging about 150 c.f.s., and the water temperature was 48.0°F. The gradient is fairly steep except for a section of moderate gradient extending 3½ miles, which contains most of the spawning area. There were 25,000 square yards of suitable spawning area, constituting approximately 15 percent of the total bottom in the portion surveyed. The stream is seldom frequented, and fish suffer practically no molestation by man. Warm Spring Creek has a small run of chinook salmon and a spring run of steelhead trout. It is capable of supporting a larger salmon run.

1C-(3)b-i. Trapper Creek.-- (June 25, 1941; Frey and Bryant.) Trapper Creek enters Warm Spring Creek approximately 10 miles above the mouth. The stream is about 7 miles long, of which the lower 1½ miles

were surveyed. It was found to be inaccessible and of no value to salmon above the upper terminus of the survey because of numerous beaver dams and the small volume of flow. Several beaver dams, log jams, and small falls in the portion surveyed were considered barriers at low water or passable only with great difficulty. Near the mouth the stream was 12 ft. wide, discharging about 25 c.f.s., and the water temperature was 43.0°F. The gradient is fairly steep in the lower portion, and increases upstream. There were 2,100 square yards of suitable spawning area, constituting approximately 23 percent of the total bottom in the portion surveyed. A small run of chinook salmon enters Trapper Creek, and the stream can accommodate only a few spawners.

1C-(3)c. Mayfield Creek.-- (June 21, 1941; Bryant.) Mayfield Creek enters Loon Creek approximately 23½ miles above the mouth. The main stream extends only 2½ miles, where it is formed by the union of the east and west forks. It had an average width of 24 ft., and was discharging more than 100 c.f.s. The water temperature at the forks was 43.0°F. The gradient is fairly steep, with numerous cascades. There were only 1,800 square yards of suitable spawning area, constituting approximately 4 percent of the total bottom. Several log jams and beaver dams were considered to be passable only with great difficulty. There are three small unscreened irrigation ditches, none diverting more than 5 c.f.s. A few chinook salmon and steelhead trout spawn in main Mayfield Creek, but it is not of importance as a salmon producer.

1C-(3)c-i. West Fork, Mayfield Creek.-- (June 21, 1941; Bryant.) The West Fork enters Mayfield Creek approximately 2½ miles above the mouth. The stream is about 6 miles long, of which the lower 2½ miles were surveyed. At the mouth it was 21 ft. wide, discharging about 40 c.f.s., and the water temperature was 43.0°F. The gradient is steep, with numerous cascades. There were only 1,600 square yards of suitable spawning area, constituting approximately 7 percent of the total bottom in the portion surveyed. Numerous beaver dams were passable to fish only with great difficulty. Although a few chinook salmon and steelhead trout were reported to enter the West Fork, it was regarded as a poor salmon stream.

1C-(3)c-ii. East Fork, Mayfield Creek.-- (June 21, 1941; Frey.) The East Fork enters Mayfield Creek approximately 2½ miles above the mouth. The stream is about 14 miles long, of which the lower 2 miles were surveyed. It was inaccessible and of no value to salmon above the terminus of the survey because of a log jam and a series of beaver dams. Near the mouth the stream was 18 ft. wide, discharging about 30 c.f.s., and the water temperature was 44.0°F. The gradient is fairly steep, except for a section of moderate gradient starting 1½ miles above the mouth and extending several miles, which was largely inaccessible. There were 3,900 square yards of suitable spawning area, constituting approximately 20 per cent of the total bottom in the portion surveyed. Although small runs of chinook salmon and steelhead trout were reported to enter the stream, it was considered of slight value at present as a salmon producer.

1C-(3)d. Trail Creek.-- (June 20, 1941; Bryant.) Trail Creek enters Loon Creek approximately 24 miles above the mouth. The stream is about 6½ miles long, of which the lower 2 miles were surveyed. It was 12 feet wide near the mouth, and was discharging about 25 c.f.s. The gradient is fairly steep. There were only 500 square yards of suitable spawning area, constituting approximately 12 percent of the total bottom in the portion surveyed. An impassable beaver dam was found 950 yards above the mouth, and there are numerous other beaver dams throughout the stream. Two small, unscreened irrigation ditches were observed, each diverting 3-5 c.f.s. No salmon were reported to enter Trail Creek, and probably no run exists. The stream could not be of more than slight value to salmon.

1C-(3)e Pioneer Creek.-- (June 20, 1941; Frey.) Pioneer Creek enters Loon Creek approximately 25½ miles above the mouth, above an impassable beaver dam on Loon Creek. The stream was therefore entirely inaccessible to migratory fish. It is about 6 miles long, of which the lower mile was surveyed. The stream was of no possible value to salmon above the terminus of the survey because of the increasingly steep gradient. It was 21 ft. wide at the mouth and discharging about 35 c.f.s. There were only 250 square yards of suitable spawning area, constituting approximately 3 percent of the total bottom in the portion surveyed. Pioneer Creek is of no present value and of practically no potential value to salmon.

1C-(4). Little Loon Creek.-- (July 9, 1941; Frey and Bryant.) Little Loon Creek enters the Middle Fork approximately 55½ miles above the mouth. The stream is about 11 miles long, of which the lower 3 miles were surveyed, up to a series of beaver dams forming an impassable barrier to fish. Near the mouth it was 12 feet wide, discharging about 25 c.f.s., and the water temperature was 47.0°F. The gradient is fairly steep in the lower 3 miles and increases upstream. There were 3,600 square yards of suitable spawning area, constituting approximately 16 percent of the total bottom in the portion surveyed. A falls 6 feet in height is located at the mouth and is probably a barrier at low water. Numerous beaver dams were found in the section surveyed, rendering the passage of fish extremely difficult. The U. S. Forest Service reported that Little Loon Creek formerly supported a small run of chinook salmon before the influx of beavers in recent years. No salmon were seen during the survey, and it is doubtful if any enter at present. The stream has some potential value for a small salmon population.

1C-(5). Marble Creek.-- (July 11, 1941; Frey and Bryant.) Marble Creek enters the Middle Fork approximately 63 miles above the mouth. The stream is about 24 miles long, of which the lower 11 miles were surveyed. Near the mouth it was 42 feet wide, discharging between 125 and 150 c.f.s., and the water temperature was 52.0°F. The gradient is fairly steep, and

increases rapidly above the terminus of the survey. There were 9,700 square yards of suitable spawning area, constituting approximately 4 percent of the total bottom in the portion surveyed. It was reported that Marble Creek formerly supported a good run of chinook salmon. No salmon were seen during the survey, and the run is now greatly depleted. There was considerable mining pollution in the stream at the time of the survey. The effect of this pollution on fish should be investigated. The stream has some potential value as a salmon producer.

1C-(6). Indian Creek.— (July 13-15, 1941; Frey and Bryant.) Indian Creek enters the Middle Fork approximately 69 miles above the mouth. The stream is about 22 miles long, of which the lower 13½ miles were surveyed. Near the mouth it was 30 ft. wide, discharging 119 c.f.s., and the water temperature was 57.0°F. The gradient is moderate in the lower 3 miles, and increases upstream. There were 17,000 square yards of suitable spawning area, constituting approximately 9 percent of the total bottom in the portion surveyed. Two log jams were considered to be possible barriers to fish at low water. A falls 7 ft. in height located 11½ miles above the mouth was considered a barrier at low water. No salmon were seen during the survey. Indian Creek extends through a remote area, and the salmon run has not been subjected to molestation by man. Although it is of little or no value as a salmon producer at present, it has some good spawning area and appears capable of supporting a fair run.

1C-(7). Pistol Creek.— (July 15-16, 1941; Frey and Bryant.) Pistol Creek enters the Middle Fork approximately 74 miles above the mouth. The main stream extends for about 3½ miles to the forks. The average width of the stream was 33 ft. and the discharge at the mouth was 171 c.f.s. The water temperature range was between 50 and 60°F. The gradient is fairly steep throughout. There were 3,200 square yards of suitable spawning area, constituting approximately 5 percent of the total bottom. The U. S. Forest Service reported a run of chinook salmon in Pistol Creek during past years, but the U. S. Forest Guard stationed near the mouth reported that none had been seen that season. No salmon were seen during the survey, although spawners should have been present at that time. A run of steelhead trout was reported to enter during the spring. This entire portion of the Middle Fork of the Salmon River drainage system is subject to local severe flash floods, which may be very destructive to salmon if they should occur at certain critical stages of the reproductive period. Evidence of such floods was found in Pistol Creek and several of its tributaries. Although the stream is apparently of little value as a salmon producer at present, it seems capable of supporting a fair run.

1C-(7)a. Big Pistol Creek.-- (July 16, 1941; Bryant.) Big Pistol Creek enters main Pistol Creek about 3½ miles above the mouth. The stream is approximately 15 miles long, of which the lower 6 miles were surveyed. Near the mouth it was 18 ft. wide, discharging about 80 c.f.s., and the water temperature was 51.0°F. The gradient is fairly steep except for a few small flats. There were 8,500 square yards of suitable spawning area constituting approximately 13 percent of the total bottom in the portion surveyed. Most of the good spawning area was found in the lower 3 miles. Two log and debris jams and numerous beaver dams found in the upper half of the portion surveyed were very difficult for fish to ascend, and were probably barriers at low water. The U.S. Forest Service reported that a small run of chinook salmon formerly entered the stream, but that no salmon had been seen here for several years. A fair run of steelhead trout was reported to enter in the spring. The cause of the present salmon depletion is not known, but may be due partly to severe and recurrent flash floods. Big Pistol Creek extends through a remote area, and the salmon run has not been subjected to molestation by man. It is of no value as a salmon producer at present, but has some potential value and appears capable of supporting a fair run.

1C-(7)b. Little Pistol Creek.-- (July 16, 1941; Frey.) Little Pistol Creek enters main Pistol Creek about 3½ miles above the mouth. The stream is approximately 13 miles long, of which the lower 7 miles were surveyed. Near the mouth it was about 30 ft. wide, discharging between 75 and 80 c.f.s., and the water temperature was 51.0°F. The gradient is slight to moderate in the lower 2 miles, increasing upstream until above the terminus of the survey it is too steep for the stream to be of possible value to salmon. There were 13,000 square yards of suitable spawning area, constituting approximately 15 percent of the total bottom in the portion surveyed. Several log and debris jams were considered as probable barriers to fish at low water. The U. S. Forest Service reported that a good run of chinook salmon formerly entered the stream, but that no salmon had been reported for the past several years. A fair run of steelhead trout was reported to enter in the spring. The salmon run has not been subjected to molestation by man in this stream. No salmon were seen during the survey. Although Little Pistol Creek is of slight or no value as a salmon producer at present, it has some good spawning area and appears capable of supporting a fair run.

1C-(8). Rapid River.-- (July 17-18, 1941; Frey and Bryant.) Rapid River enters the Middle Fork approximately 78 miles above the mouth. The stream is about 20 miles long, of which the lower 12½ miles were surveyed. Near the mouth it was about 30 ft. wide, discharging about 150 c.f.s., and the water temperature was 58.0°F. There was little decrease in volume upstream in the portion surveyed, the flow at the upper terminus being about 120 c.f.s. The gradient is steep to moderate. There were 28,000 square yards of suitable spawning area, constituting approximately 15 percent of the total bottom in the portion

surveyed. The U. S. Forest Service reported that a small run of chinook salmon had entered Rapid River in past years. No salmon were seen during the survey. A small run of steelhead trout was reported to enter in the spring. The lower portion of the watershed has been denuded by fire, and the stream is subject to damaging flash floods. Severe erosion of the watershed and banks was observed in many places. Although the stream is of little value as a salmon producer at present, it has excellent potential value and should support a good run.

1C-(9). Soldier Creek.— (July 21, 1941; Frey.) Soldier Creek enters the Middle Fork approximately 85½ miles above the mouth. The stream is about 8 miles long, of which the lower 3 miles were surveyed. It is of no possible value to salmon above the upper terminus of the survey because of the increasingly steep gradient and numerous beaver dams. Near the mouth the stream was about 15 ft. wide, discharging between 30 and 40 c.f.s., and the water temperature was 48.0°F. The gradient is fairly steep. There were 900 square yards of suitable spawning area, constituting approximately 5 percent of the total bottom in the portion surveyed. Several log and debris jams were considered to be passable to fish only with difficulty. There was no pollution at the time of the survey, but mine operators expected to have a quartz mill operating at a point ½ mile above the mouth in the year 1942. It was reported that no salmon or steelhead enter the stream. No salmon were seen during the survey. Soldier Creek is of no present value and of little potential value as a salmon producer.

1C-(10). Elkhorn Creek.— (July 21, 1941; Frey.) Elkhorn Creek enters the Middle Fork approximately 88 miles above the mouth. It is a small stream, intermittent in the upper portion. The gradient is fairly steep, and increases upstream. Several bad log and debris jams were found, including one located 1 mile upstream which was considered a total barrier to fish. There were less than 100 square yards of suitable spawning area. The stream is of no present or potential value to salmon.

1C-(11). Sulphur Creek.— (July 23, 1941; Frey.) Sulphur Creek enters the Middle Fork approximately 94½ miles above the mouth. The stream is about 19 miles long, of which the lower 10 miles were surveyed. Near the mouth it was 30 ft. wide, discharging about 60 c.f.s., and the water temperature was 53.0°F. The gradient is moderate for the most part, becoming fairly steep above the terminus of the survey. There were 37,000 square yards of suitable spawning area, constituting approximately 27 percent of the total bottom in the portion surveyed. The watershed in the first 3 miles above the mouth was burned over in 1940. This area was covered with fallen trees, and several log jams had begun to form. The lower part of the stream should be checked for obstructions after each spring high-water period to insure free access to salmon. Sulphur Creek is an excellent chinook salmon stream, and supports a fair run. One hundred twenty-eight

salmon were counted in pools during the survey, and many more probably were unobserved because the fish had not yet moved onto the spawning riffles. The stream is capable of supporting a much larger run than was observed, although the entire run may not have ascended from the Middle Fork at the time of the survey.

1C-(12). Marsh Creek.-- (July 24-25, 1941; Frey and Bryant.) Marsh Creek enters the Middle Fork approximately 106½ miles above the mouth. The stream is about 14½ miles long, of which the lower 11½ miles were surveyed. Near the mouth it was 66 feet wide, discharging between 275 and 300 c.f.s., and the water temperature was 53.0°F. The gradient is moderate throughout. There were 33,000 square yards of suitable spawning area, constituting approximately 16 percent of the total bottom in the portion surveyed. The upper 5 miles of the portion surveyed has a large amount of good spawning area. Marsh Creek formerly supported a large run of chinook salmon, but in the last 20 years, particularly in the decade preceding 1940, the run had been almost exterminated by the former unrestricted practice of spearing salmon on the spawning beds. At present it supports a very small run of salmon; only nine adult chinooks and five completed nests were seen during the survey. A fair spring run of steelhead trout was reported. The stream is of little value in salmon production at present, but it has great potential value.

1C-(12)a. Beaver Creek.-- (July 29, 1941; Frey and Bryant.) Beaver Creek enters Marsh Creek 5 miles above the mouth. The stream is about 15 miles long, of which the lower 11 miles were surveyed. Near the mouth it was about 40 ft. wide, discharging 90 c.f.s., and the water temperature was 45.0°F. The gradient is moderate in the lower 10 miles, and becomes steep in the upper part. There were 35,000 square yards of suitable spawning area, constituting approximately 22 percent of the total bottom in the portion surveyed. The U. S. Forest Service reported that up to the year 1930 Beaver Creek supported a large run of chinook salmon. The history of the depletion of the run is identical with that of Marsh Creek. At present it supports a very small run of salmon; 11 adult chinooks and 24 nests were seen during the survey. A spring run of steelhead trout was reported. The stream is of little value in salmon production at present, but it has great potential value.

1C-(12)b. Cape Horn Creek.-- (July 24-25, 1941; Frey and Bryant.) Cape Horn Creek enters Marsh Creek about 6 miles above the mouth. The stream is approximately 9½ miles long, of which the lower 5½ miles were surveyed. It is of no value and inaccessible to salmon above the terminus of the survey because of the small valume of flow and numerous beaver dams. Near the mouth the stream was 24 ft. wide and discharging about 60 c.f.s. Water temperatures were favorable for salmon, ranging between 45 and 52°F. The gradient is slight to moderate in the lower 5½ miles, and becomes steep in the upper part. There were 28,000 square yards of suitable spawning area, constituting approximately 44 percent of the total bottom in the portion surveyed. Cape Horn Creek

formerly supported a large run of chinook salmon. The history of the depletion of the run is identical with that of Marsh Creek. At present it supports a very small salmon population; 44 live adult chinooks, 4 dead spawned-out chinooks, and 46 nests were seen during the survey. A spring run of steelhead trout was reported. The stream is of small value as a salmon producer at present, but it has great potential value.

1C-(12)b-i. Banner Creek.-- (July 28, 1941; Frey and Bryant.) Banner Creek enters Cape Horn Creek 5½ miles above the mouth. The stream is approximately 4 miles long, of which about 1 mile was surveyed. It is of no possible value to salmon above the terminus of the survey because of the steep gradient and low volume of flow. Near the mouth the stream was 15 ft. wide, discharging about 15 c.f.s., and the water temperature was 49.0°F. The gradient is slight to moderate in the lower mile, and becomes steep above. There were 1,900 square yards of suitable spawning area, constituting approximately 34 percent of the total bottom in the portion surveyed. A log jam located a short distance above the terminus of the survey was considered to be a barrier to fish. Although too small to have ever accomodated a large run, the stream formerly supported a much larger salmon population than at present. The history of the depletion of the run is identical with that of Marsh Creek. The present salmon run is very small; 4 live adult chinooks, 1 dead spawned-out chinook, and 7 nests were seen during the survey. A spring run of steelhead trout was reported. The stream is of little value as a salmon producer at present, but it has some potential value.

1C-(12)c. Knapp Creek.-- (July 25, 1941; Bryant.) Knapp Creek enters Marsh Creek 10 miles above the mouth. The stream is approximately 15 miles long, of which about 1 mile was surveyed. The small volume of flow and numerous beaver dams located about 2 miles above the mouth render the stream of little value to salmon above that point. Near the mouth it was 15 ft. wide and discharging about 10 c.f.s. The gradient is slight to moderate in the lower 3 miles, and becomes steep in the upper part. There were 1,200 square yards of suitable spawning area, constituting approximately 26 percent of the total bottom in the portion surveyed. Water conditions at the time of the spawning migration affect the amount of spawning area available. Knapp Creek formerly supported a good number of chinook salmon for a stream of its small size. The history of the depletion of the run is identical with that of Marsh Creek. A few salmon still enter the stream; no spawners and only two nests were seen during the survey. A spring run of steelhead trout was reported. The stream is of little value as a salmon producer at present, but it has some potential value.

1C-(13). Bear Valley Creek.-- (July 25-27, 1941; Frey and Bryant.) Bear Valley Creek enters the Middle Fork approximately 106½ miles above

the mouth. The stream is about 37 miles long, of which the lower 27 miles were surveyed. Near the mouth it was about 50 feet wide, discharging more than 200 c.f.s., and the water temperature was 58.0°F. The gradient is mostly slight to moderate. There were 150,000 sq. yd. of suitable spawning area, constituting approximately 21 percent of the total bottom in the portion surveyed. Several beaver dams render the upper part of the stream difficult of access to salmon. Bear Valley Creek formerly supported a large run of chinook salmon. The history of the depletion of the run is identical with that of Marsh Creek. At present it supports a very small run of salmon; 17 live adult chinooks, 1 dead spawned-out chinook, and 6 nests were seen during the survey. A spring run of steelhead trout was reported. The stream is of slight value as a salmon producer at present, but it has great potential value.

1C-(13)a. Elk Creek.-- (July 28, 1941; Frey and Bryant.) Elk Creek enters Bear Valley Creek 11 miles above the mouth. The stream is approximately 22 miles long, of which the lower 13 miles were surveyed. Near the mouth it was 36 ft. wide, and was discharging about 100 c.f.s. The water temperature was 53.0°F. The gradient is mostly slight. There were 41,000 sq. yd. of suitable spawning area, constituting approximately 19 percent of the total bottom in the portion surveyed. Elk Creek formerly supported a large run of chinook salmon. The history of the depletion of the run is identical with that of Marsh Creek. At present it supports a very small run of salmon; 5 live adult chinooks, 1 dead spawned-out chinook, and 16 nests were counted during the survey. A spring run of steelhead trout was reported. The stream is of slight value as a salmon producer at present, but it has a great potential value.

1C-(13)b. Sack Creek.-- (July 27, 1941; Bryant.) Sack Creek enters Bear Valley Creek approximately 18 miles above the mouth. The stream is about 5½ miles long, of which the lower 1½ miles were surveyed. It was too small to be of any value to salmon above the terminus of the survey. Near the mouth the stream was 6 feet wide and was discharging less than 10 c.f.s. The gradient is slight to moderate. There were only 500 sq. yd. of suitable spawning area, constituting approximately 14 percent of the total bottom in the portion surveyed. Two beaver dams in the lower 200 yd. were considered to be passable with difficulty. No salmon were seen during the survey. Sack Creek is of little possible value to salmon because of its small size.

1C-(13)c. Cache Creek.-- (July 27, 1941; Frey.) Cache Creek enters Bear Valley Creek approximately 19½ miles above the mouth. The stream is about 6 miles long, of which the lower 2 miles were surveyed. It was too small to be of value to salmon above the terminus of the survey. Near the mouth the stream was about 15 feet wide, discharging about 15 c.f.s., and the water temperature was 54.0°F. The gradient is slight

to moderate in the lower part, and becomes fairly steep above the terminus of the survey. There were 3,100 sq. yd. of suitable spawning area, constituting approximately 20 percent of the total bottom in the portion surveyed. No salmon were seen during the survey, and it was reported that none enter the stream. Although not capable of supporting a large run because of its small size, Cache Creek has some potential value to salmon.

1D. Panther Creek.-- (July 11, 1941; Parkhurst and Zimmer.) Panther Creek enters the main Salmon River approximately 203 miles above the mouth. The stream is about 43 miles long, of which 10½ miles were surveyed. The lower part, from the mouth to the confluence of Napias Creek, a distance of about 20 miles, was not surveyed in detail because it was rendered extremely turbid by the discharge of mining silt from Napias Creek. The stream bed is composed largely of bedrock and large rubble for a distance of 22½ miles above the mouth, and there is little suitable spawning area in this lower portion. Near the mouth the stream was 40 feet wide, discharging about 150 c.f.s., and the water temperature was 62.5°F. Just above the mouth of Napias Creek the stream was about 30 ft. wide, discharging about 30 c.f.s., and the water temperature was 53.0°F. The gradient is fairly steep in the lower part of the stream, becoming moderate in the surveyed portion. The upper 8 miles of the portion surveyed has a very high concentration of suitable spawning area. There were 82,000 sq. yd. of suitable spawning area, constituting approximately 45 percent of the total bottom in the portion surveyed. The stream is of little possible value to salmon above the terminus of the survey because of its small size. Three low irrigation diversion dams, one abandoned mining diversion dam, and several beaver dams and log jams were found. None of these were total barriers to fish, but two of the irrigation dams and a log jam appeared to be passable only with difficulty at low water stages. Only one irrigation diversion dam was in operation, the ditch withdrawing about 1 c.f.s. Panther Creek formerly supported a good run of chinook salmon. It was reported that the run has declined steadily in recent years. At present very few salmon enter the stream; four adult chinooks were seen during the survey. It is of slight value as a salmon producer at present, but has good potential value.

1D-(1). Napias Creek.-- (Inspected July 11, 1941; Parkhurst and Zimmer.) Napias Creek enters Panther Creek approximately 20 miles above the mouth. The stream is about 13 miles long. Near the mouth it had an average width of more than 20 feet, and was discharging about 90 c.f.s. The gradient is extremely steep. The stream is inaccessible to salmon a short distance above the mouth because of the many falls and cascades. The water was extremely muddy at the time of observation, the stream carrying a large amount of silt from gold mines at Leesburg in the headwaters. Napias Creek has practically no suitable spawning area, and is of no present or potential value to salmon.

1E. North Fork, Salmon River.— (Inspected July 10, 1941; Parkhurst and Zimmer.) The North Fork enters the main Salmon River approximately 229 miles above the mouth. The stream is about 23 miles long. Near the mouth it was 34 feet wide, discharging about 80 c.f.s. and the water temperature was 55.0°F. The gradient is moderate to fairly steep. The water was extremely muddy for a distance of 17 miles above the mouth. Above this point the stream was too small and steep to be of value to salmon. The extreme turbidity was due to a large gold mine at Gibbonsville, 11 miles above the mouth, and a number of smaller mining operations at various points along the stream. Under natural conditions the stream contained a fair amount of suitable spawning area, but the stream bed had become so heavily silted as a result of mining activity that it was of no value to salmon at the time of the survey. The North Fork originally supported a run of chinook salmon, but it was reported that no salmon had been seen in it for many years.

1F. Lemhi River.— (June 30 - July 8, 1941; Parkhurst and Zimmer.) The Lemhi River enters the Salmon River at Salmon, Idaho, approximately 251 miles above the mouth. The stream is about 60 miles long. Near the mouth it was 32 feet wide, discharging about 15 c.f.s. and the water temperature was 59.0°F., most of the flow being diverted. The gradient is moderate throughout. Spawning area is abundant, of excellent quality, and well distributed. There were 880,000 sq. yd. of suitable spawning area, constituting approximately 59 percent of the total bottom.

The Idaho Power Company maintains a diversion dam 6 feet in height at a point 1 mile above the mouth of the river. This dam is not equipped with fishways, and is a barrier to salmon except during the June high water stage, when a few early-arriving chinook salmon succeed in passing it. During low water periods the entire flow is diverted except for seepage. At the time of observation the dam was impassable to fish, and was diverting 312 c.f.s. into the canal leading to the power plant. The diversion is not equipped with any fish protective devices. The tailrace discharges into the main Salmon River less than 1/2 mile below the power plant, and a short distance below the mouth of the Lemhi River. Since this diversion takes almost the entire flow during the time when most of the salmon should be entering the stream, the majority of these fish ascend the tailrace to the power plant, where they are completely obstructed. The turbines operate under a 38 foot head. They are the low speed, reaction type, and probably do not greatly injure the downstream migrants.

There is an irrigation diversion located about 3 miles above the mouth which was withdrawing about 20 c.f.s. at the time of observation. The dam in connection with this diversion is on a side channel and is not a barrier to fish.

There is an irrigation dam 3 feet in height located 7½ miles above the mouth. No fishway is provided and the dam is a barrier at low water. The ditch was withdrawing about 30 c.f.s.

There are numerous other low irrigation dams on the Lemhi River. These are all passable to fish, most of them being temporary wing dams. Most of the diversions are small. Measurements were taken on 24 of the irrigation ditches, which were withdrawing a total of 143 c.f.s. There are no fish screens on any of the water diversions from this stream.

At the terminus of the survey the Lemhi River is formed by the union of several small streams, namely IF-(3) Canyon Creek, IF-(4) Eighteenmile Creek, and IF-(5) Texas Creek. The discharge of each of these headwater streams was approximately 2 c.f.s., and they were considered to be of little value to salmon because of their small size.

The Lemhi River formerly supported an excellent run of chinook salmon. The U. S. Fisheries Station at Salmon, Idaho conducted the artificial propagation of chinook salmon on the Lemhi River during the years 1920-1933, but despite this effort the run has been depleted. No salmon were seen during the survey. The stream is of little value as a salmon producer at present, but it has great potential value.

IF-(1). Wimpey Creek.— (July 1, 1941; Zimmer.) Wimpey Creek enters the Lemhi River approximately 12½ miles above the mouth. The stream is about 8 miles long, of which about 1½ miles were surveyed. Near the mouth it was 42 feet wide and discharging about 75 c.f.s. The gradient is moderate in the lower 3 miles, becoming steep above. The lower 1/2 mile contains a high concentration of excellent spawning gravel. There were 3,800 sq. yd. of suitable spawning area, constituting approximately 24 percent of the total bottom in the portion surveyed. The stream formerly supported a good run of chinook salmon, but it has been greatly depleted. No salmon were seen during the survey. Although Wimpey Creek has been adversely affected by obstructions and diversions in the Lemhi River, it has some potential value for salmon.

IF-(2). Hayden Creek.— (Inspected July 8, 1941; Parkhurst and Zimmer.) Hayden Creek enters the Lemhi River approximately 33 miles above the mouth. The stream is about 20 miles long. Near the mouth it was 27 feet wide, discharging about 60 c.f.s., and the water temperature was 57.0°F. The gradient is fairly steep throughout. The stream bed is composed chiefly of large rubble, and there is little suitable spawning area. Hayden Creek was considered to be of slight value to salmon.

IG. Pahsimeroi River.— (July 9, 1941; Parkhurst and Zimmer.) The Pahsimeroi River enters the Salmon River 18 miles below Challis, Idaho, or approximately 295 miles above the mouth. The stream is about 30 miles long, of which about 27 miles were surveyed. It was too small to be of possible value to salmon above the terminus of

the survey. Near the mouth the stream was about 50 feet wide, discharging about 150 c.f.s., and the water temperature was 58.0°F. The volume of flow diminished rapidly upstream. The gradient is moderate throughout the portion surveyed. There were 120,000 sq. yd. of suitable spawning area, constituting 55 percent of the total bottom in the portion surveyed. Numerous small irrigation ditches were found throughout. None of these diversions were equipped with fish screens. The total amount of water being diverted was considerable, and in several places the stream bed was practically dry. There was some silting of the stream bed. This was due mainly to returns from irrigation ditches and partly to placer mining on several small tributaries. The Pahsimeroi River formerly supported a good run of chinook salmon and steelhead trout. Eggs were taken from chinook salmon spawners in this stream and removed to the U. S. Fisheries Station at Salmon, Idaho during the years 1923 through 1927. Some fingerlings were liberated in the Pahsimeroi River, but the run has declined steadily. The stream is of little present or potential value as a salmon producer, due mainly to the extensive withdrawal of water for agricultural purposes.

1H. East Fork, Salmon River.-- (Not surveyed) The East Fork enters the Salmon River 5 miles below Clayton, Idaho, or approximately 336 miles above the mouth. The stream is about 32 miles long. It was reported to support a small run of chinook salmon.

1I. Yankee Fork, Salmon River.— (June 19, 1941; Frey and Bryant.) The Yankee Fork enters the Salmon River 12 miles below Stanley, Idaho, or approximately 360 miles above the mouth. The stream is about 25 miles long. The discharge was 445 c.f.s. (U.S.G.S.,1942). The Yankee Fork was extremely muddy at the time of observation, due to the extensive operations of a large gold-mining dredge. Although a few chinook salmon were reported to enter the stream, it was considered of little value as long as dredging continues because of excessive silting of the stream bed.

1J. Valley Creek.— (July 4, 1941; Frey and Bryant.) Valley Creek enters the Salmon River at Stanley, Idaho, approximately 372 miles above the mouth. The stream is about 21 miles long. The discharge was 232 c.f.s. (U.S.G.S., 1942). Valley Creek was very muddy at the time of observation, due to a gold dredging operation in the headwaters. The stream was reported to support a small run of chinook salmon.

1K. Redfish Lake Creek.— (July 20, 1941, and Oct. 8, 1942; Bryant.) Redfish Lake Creek enters the Salmon River 5 miles above Stanley, Idaho, or approximately 377 miles above the mouth. The stream extends for 3/4 mile to Little Redfish Lake, which is almost circular and 1/2 mile in diameter. From the upper end of Little Redfish Lake it extends for 1½ miles to Big Redfish Lake. Big Redfish Lake is about 4 miles long. The stream is impassable to salmon a short distance above the head of Big Redfish Lake because of falls

and cascades. The stream was 36 feet wide at the mouth, and discharging about 80 c.f.s. on July 20, 1941. On Oct. 8, 1942, the discharge at the mouth was about 50 c.f.s. There were 45,000 sq. yd. of suitable spawning area, constituting approximately 62 percent of the total bottom. A log jam 500 yards below the outlet of Big Redfish Lake was found to be passable with difficulty. It was reported that no chinook salmon enter the stream and none of this species was seen during the survey. No blueback salmon were seen in the stream, but they were observed spawning in Big Redfish Lake in October, 1942. It was reported that the bluebacks do not spawn in Redfish Lake Creek, but that the resident form of the same species, locally known as "Little Redfish" migrate from the lakes into the stream in August to spawn. The chief value of Redfish Lake Creek to salmon appears to be its use as a passageway by the small, greatly depleted run of blueback salmon that enters Big Redfish Lake.

Summary of Recommendations

Because of the greatly depleted condition of the salmon populations in the upper main Salmon River and upper Middle Fork, every effort should be made to protect and facilitate the natural spawning of the remnants of these runs.

On the Lemhi River a fishway should be constructed from the tailrace to the forebay of the Idaho Power Company's plant at Salmon, Idaho. An irrigation diversion dam located about 7½ miles above the mouth should also be provided with a fishway and the diversion screened.

TABLE OF *OBSTRUCTIONS AND DIVERSIONS

Name of Stream	Name of obstruction or diversion	Height in feet		Diversion in c.f.s.	Protective Devices	
		Falls	Dams		Present	Needed
Lemhi River	Idaho Power Co. Dam		6	300	None	Fishway
" "	Irrigation diversion			20	None	Screen
" "	Irrigation diversion		3	30	None	Fishway and screen

*This tabulation includes only those obstructions and diversions that would seriously interfere with runs of salmon and steelhead in the stream.

PART 2

SUB-AREA WEISER RIVER SYSTEM

CONTENTS

	Page
Introduction	32
List of Streams	33
The Survey	35
Summary of Recommendations	43
Table of Obstructions and Diversions	44

Introduction

The Weiser River joins the Snake River approximately 342 miles above the confluence of the Snake and Columbia Rivers. Its drainage area comprises approximately 1700 square miles of west-central Idaho. The total stream length of the system, including all major tributaries, is more than 600 miles.

The Weiser River watershed embraces several rich agricultural valleys, but the arid nature of the region necessitates the extensive use of irrigation facilities for the successful production of crops. Water is consequently the dearest and most contested resource of the area. Water rights have been granted for much more water than there is available during periods of normal flow. On several streams practically all of the water is diverted at certain points during the summer, leaving sections of dry stream bed. Water is also transferred from one tributary to another, and even brought in from the Little Salmon River watershed. There are 167 irrigation diversions in the system, not one of which is screened to prevent the loss of fish.

In the early days before the agricultural development of this region, the Weiser River System was a valuable area for the reproduction of salmon. Large runs of chinook salmon formerly utilized the extensive spawning area in both the main stream and its principal tributaries. These runs have gradually become depleted, the last fair-sized run of chinooks being reported as occurring in 1931. A few salmon continue to appear, spawning mainly in the upper Little Weiser River early in September. A fairly good run of steelhead trout still enters the river during the spring high water period and ascends the tributaries to spawn.

List of Streams

Page

2. Main Weiser River 35

A. Mann Creek 35

(1) Adams Creek 36

(2) Stacy Creek 36

(3) Fourth of July Creek 36

a. Porcupine Creek 36

(4) Hitt Creek 36

(5) Bear Creek 36

B. Cove Creek 37

C. Bear Creek 37

D. Crane Creek 37

E. Sage Creek 37

F. Keithley Creek 37

G. Little Weiser River 37

(1) Grays Creek 38

H. Pine Creek 38

I. Spring Creek 38

J. Rush Creek 38

K. Grizzly Creek 39

L. Cow Creek 39

M. Bacon Creek 39

N. Goodrich Creek 39

O. Johnson Creek 39

List of Streams (continued)

		Page
P.	Middle Fork, Weiser River	39
	(1) Fall Creek	40
Q.	Cottonwood Creek	40
	(1) North Cottonwood Creek	40
R.	Hornet Creek	40
	(1) North Hornet Creek	41
	a. Left Fork	41
S.	Mill Creek	41
T.	Fort Hall Creek	41
U.	West Fork, Weiser River	41
	(1) Lost Creek	41
V.	Warm Spring Creek	42
W.	East Fork, Weiser River	42
X.	Beaver Creek	42
Y.	East Branch, Weiser River	42
Z.	West Branch, Weiser River	42

2. Main Weiser River.-- (August 16-29, 1941; Frey and Bryant.) The main Weiser River is approximately 82 miles long. Gaging-station records for the water-year 1940-41 (U.S.G.S., 1942), taken at a station about 15 miles above the mouth, show discharges ranging from a maximum of 6000 c.f.s. in December to a minimum of 51 c.f.s. in July. The stream bed in the lower part of the river is covered with a layer of silt resulting from the turbid discharge of several reservoirs located on tributary streams. The upper part is more often clear, and contains a large amount of good spawning area.

There are 13 irrigation diversions on the main Weiser. Six of these have water rights ranging from 9 to 240 c.f.s.

The Mill Ditch irrigation diversion dam is located about 11 miles above the mouth. This is a low structure, passable at high water, and not equipped with a fishway. The ditch has a water right of 9 c.f.s.

A short distance above the Mill Ditch there is located the Galloway diversion dam of the Weiser Irrigation Project. This is a concrete structure 4 feet high, with flashboards increasing the height to 5 feet. Along the base of the dam there is a concrete apron extending 12 feet downstream. A poorly designed fishway parallels the face of the dam and discharges onto the apron. It was reported that when there is sufficient spill over the dam, which usually occurs only during the spring run-off, steelhead jump directly over this obstacle. As the discharge decreases it becomes increasingly difficult for fish to pass over the long, shallow downstream apron and enter the fish ladder. There is usually little or no spill over the dam during August and September, and during these months the stream bed below is practically dry. A large part of the chinook run has sometimes been blocked at this dam, and the fish caught in large numbers. It was reported that this occurred in 1939. The Galloway ditch has a carrying capacity of 240 c.f.s., and has a right to all the water in the river at the diversion point except for the 9 c.f.s which must be supplied to the Mill ditch.

Other major irrigation diversions and their carrying capacities are the Middle Valley ditch, 60 c.f.s; the Robertson-Levey ditch, 30 c.f.s. but adjudicated for 16 c.f.s; the Sunnyside ditch, 30 c.f.s, and the Allison-Jewell ditch, about 9 c.f.s.

2A. Mann Creek.-- (August 17-28, 1941; Frey and Bryant.) Mann Creek enters the Weiser River approximately 5½ miles above the mouth. The stream is about 33 miles long, of which the lower 29 miles were surveyed. It is of small size and has a fairly steep gradient above

the terminus of the survey. Gaging-station records for the water-year 1940-41 (U.S.G.S. 1942), taken at a station 12 miles above the mouth, show discharges ranging from a maximum of 290 c.f.s. in March to a minimum of 4.1 c.f.s. in October. During the survey the stream was 12 feet wide at this point, and the flow ranged from 5.1 to 6.3 c.f.s. The water temperature ranged from 70 to 82°F. in the lower 12 miles. In the upper part the water temperature declined to 49°F. at the terminus of the survey. There are 24 water rights for Mann Creek, and 20 irrigation diversions were found. Thirteen of the dams associated with these diversions, as well as several falls and log jams, were considered to be barriers at low water. Each of these dams diverts practically the entire stream at that point during low water stages, leaving a dry channel. Wherever a point downstream is reached where the volume of flow has been built up sufficiently by irrigation returns, springs, and tributaries, another dam repeats the process.

It has been proposed that the U. S. Bureau of Reclamation build a storage dam, to be known as the Spangler dam, at a point about 14 miles above the mouth. The plans call for an earth-fill structure having a height of 118 feet. It would be provided with an outlet tunnel discharging under a head of 45 ft. No facilities are to be provided for the upstream passage of migratory fish nor for the protection of downstream migrants. However, it has been recommended that the project undertake to capture and transfer to other nearby streams such migratory fish as may appear below the dam during the first few years after its construction.

There were 9,300 square yards of suitable spawning area, constituting approximately 6 percent of the total bottom in the portion surveyed. Most of the suitable spawning was found in the upper part of the stream, above the proposed Spangler dam, and is available only at high water and only to steelhead trout.

Reports indicate that many years ago Mann Creek supported good runs of chinook salmon and steelhead. The salmon run has been practically exterminated, and there remains only a small spring run of steelhead. A few of these fish ascend several of the upper tributaries, including 2A-(1) Adams Creek, 2A-(3) Fourth of July Creek, 2A-(4) Hitt Creek, and 2A-(5) Bear Creek. It was reported that they do not enter 2A-(2) Stacy Creek, and probably not 2A-(3)a Porcupine Creek.

The protection and rehabilitation of this small run of steelhead would be doubtful of success because of the numerous existing dams and diversions, and also because of the difficulties which would be encountered in the passage of both upstream and downstream migrants over the proposed high Spangler dam. The cost of a rehabilitation program would also not be warranted by the results which might be achieved.

2B. Cove Creek.-- (Not surveyed.) Cove Creek enters the Weiser River approximately 9 miles above the mouth. It is about 11 miles long. Although there are no diversions on the stream, it carries very little water during the summer months. There were no reports of salmon entering Cove Creek, and it is of no value to migratory fish.

2C. Bear Creek.-- (Not surveyed.) Bear Creek enters the Weiser River approximately 12 miles above the mouth. It is a small stream, about 4½ miles long. Although there are no diversions on Bear Creek, it normally carries very little water. It is of no value to migratory fish because of its small size.

2D. Crane Creek.-- (August 16, 1941; Frey and Bryant.) Crane Creek enters the Weiser River approximately 14 miles above the mouth. The stream is about 33 miles long. The discharge is entirely controlled and amounted to 140 c.f.s. at a point near the mouth on the date of inspection. Gaging-station records for the water-year 1940-41 (U.S.G.S. 1942), taken at a station ¼ mile above the mouth, show discharges ranging from a maximum of 995 c.f.s. in March to a minimum of 3 c.f.s. in May.

The Crane Creek dam is located 12 miles above the mouth. It is a high storage dam for irrigation, not equipped with fishways, and is a total barrier to migratory fish. The stream bed below the dam is often practically dry when water is being impounded, and for this reason Crane Creek must be considered of no present or potential value to salmon.

2E. Sage Creek.-- (Not surveyed.) Sage Creek enters the Weiser River approximately 27 miles above the mouth. It is a small stream, about 13 miles long. Three irrigation ditches take the entire flow during the summer, the creek becoming dry about the middle of June. For this reason it is of no present or potential value to salmon.

2F. Keithley Creek.-- (Not surveyed.) Keithley Creek enters the Weiser River approximately 29½ miles above the mouth. The stream is about 15 miles long. Thirteen irrigation diversions take almost the entire flow during late summer. A small late summer run of chinook salmon formerly utilized the spawning area, and a spring run of steelhead trout was reported. The chinook run has been reduced to only a few fish. The stream is of little present or potential value to salmon because of the extensive diversion of water for irrigation.

2G. Little Weiser River.-- (Not surveyed.) Little Weiser River enters the main stream approximately 36 miles above the mouth. The stream is about 38 miles long. Gaging station records for the water-year 1940-41 (U.S.G.S., 1942), taken at a point about 1 mile above the diversion leading to the C. Ben Ross reservoir and about 20 miles above the mouth, show discharges ranging from a maximum of 482 c.f.s. in May to a minimum of 13 c.f.s. in September. Before the C. Ben Ross reservoir was built near the town of Indian Valley in 1937 the portion of the stream below the lowest diversion was often dry during the summer. The reservoir now maintains some flow in the lower part of the stream, although the discharge at the confluence with the main Weiser is very low after the first week in June. There were 18 irrigation diversions on the stream. There is

a large amount of good spawning area above the town of Indian Valley, 15 miles above the mouth, and it was reported that in earlier years chinook salmon and steelhead spawned all along the stream from the vicinity of Indian Valley to the headwaters some 24 miles above. Although the chinook salmon have been greatly depleted, it was reported that the remnants of these runs still utilize this upper portion. The appearance of the late summer chinooks is now dependent upon satisfactory water conditions in both the lower Little Weiser River and in the main stream. Since these conditions are often unsatisfactory at the time of the spawning migration, the stream is of little present or potential value to salmon. Water conditions are much better in the spring, and the headwaters portion with its numerous tributaries has good potential value for a large run of steelhead.

2G-(1). Grays Creek.-- (Not surveyed) Grays Creek enters the Little Weiser River approximately 11 miles above the mouth. The stream is about 25 miles long. A single diversion takes the entire flow during the irrigation season, leaving the lower portion of the stream bed practically dry. Water is carried into Grays Creek from diversions on Fall Creek and the Little Weiser River. Without these two supplemental supplies for irrigation, Grays Creek would be dry for almost its entire length in late summer. Because of its use for irrigation, the stream is of no value to salmon and of little value to steelhead.

2H. Pine Creek.-- (August 27, 1941; Frey and Bryant.) Pine Creek enters the Weiser River approximately 36½ miles above the mouth. The stream is about 15 miles long, of which the lower 7 miles were surveyed. Near the mouth it was 13 feet wide, discharging between 10 and 15 c.f.s., and the water temperature was 58.0°F. The gradient is moderate, and increases above the terminus of the survey. The stream bed was heavily silted for a distance of 4½ miles above the mouth. There were 5,000 square yards of suitable spawning area, constituting approximately 10 percent of the total bottom in the portion surveyed. There were 21 small irrigation diversions. The diversion dams were all small, low structures. Most of these dams were of temporary construction, although there were several which were barriers to fish at low water. The stream formerly supported good runs of chinook salmon and steelhead. It was reported that a few chinook salmon still appear in most years, and that there is a small spring run of steelhead. Because of its extensive agricultural use, Pine Creek has little present or potential value as a salmon producer.

2-I. Spring Creek.-- (Not surveyed.) Spring Creek enters the Weiser River approximately 37 miles above the mouth. It has one small irrigation diversion. Because of its small size the stream is of no value to salmon.

2J. Rush Creek.-- (Not surveyed.) Rush Creek enters the Weiser River approximately 37½ miles above the mouth. The stream is about 17 miles long. A powerplant and an impassable falls are located about 9 miles upstream. There were 21 small irrigation

diversions. Good runs of chinook salmon and steelhead formerly utilized the spawning area, but these runs have been greatly depleted in recent years. Because of its extensive irrigation use the stream is of no present or potential value to salmon, and of only slight value to steelhead.

2K. Grizzly Creek.-- (Not surveyed.) Grizzly Creek enters the Weiser River approximately 42½ miles above the mouth. The stream is about 8 miles long. It had one small irrigation diversion of less than 1 c.f.s. The stream is not of sufficient size to be of any value to salmon or of more than slight value to steelhead.

2L. Cow Creek.-- (Not surveyed.) Cow Creek enters the Weiser River approximately 43½ miles above the mouth. The stream is about 8 miles long. There were three irrigation diversions, only one of which was of any importance. The stream is not of sufficient size to be of any value to salmon or of more than slight value to steelhead.

2M. Bacon Creek.-- (Not surveyed.) Bacon Creek enters the Weiser River approximately 44½ miles above the mouth. It is about 7 miles long. Excess water from the Mesa diversion of the Middle Fork of the Weiser River flows into a pool at the head of Bacon Creek. If it were not for this supplemental flow, Bacon Creek would be dry during the summer. There were no reports of salmon entering the stream. Because of its small size and dependence upon an unnatural flow, Bacon Creek is of no present or potential value to salmon.

2N. Goodrich Creek.-- (Not surveyed.) Goodrich Creek enters the Weiser River approximately 45½ miles above the mouth. It is about 13 miles long. There were three small irrigation diversions, the largest having a capacity of 0.4 c.f.s. The stream is one of those which were reported formerly to have supported runs of chinook salmon and steelhead. It is of little present or potential value to salmon.

2-O. Johnson Creek.-- (Not surveyed.) Johnson Creek enters the Weiser River approximately 48 miles above the mouth. It is about 13 miles long. There was one small irrigation diversion. Good runs of chinook salmon and steelhead trout formerly utilized the spawning area. Although there are occasional reports of a few chinook salmon in the stream, it is of slight present or potential value as a salmon producer. It is of more value to steelhead because water conditions are more favorable at the time of the spring steelhead spawning migration.

2P. Middle Fork, Weiser River.-- (August 19-22, 1941; Frey and Bryant.) The Middle Fork enters the Weiser River approximately 49½ miles above the mouth. The stream is about 25 miles long, of which 15 miles were surveyed. It was 9 feet wide at the mouth and discharging about 3 c.f.s. at the time of the survey. Gaging-station records for the water-year 1940-41 (U.S.G.S.), taken at a station 2½ miles above the mouth, show discharges ranging from a maximum of 640 c.f.s. in May to a minimum of no flow in part of August. The discharge at this point on the date of observation was 7 c.f.s. The gradient is moderate in the lower portion and increases upstream, becoming fairly steep above Mesa Dam.

From the mouth to Mesa Dam there were 5,200 square yards of suitable spawning area, constituting approximately 5 percent of the total bottom in that area. Spawning below the Mesa Dam would probably be unsuccessful because of seasonal low flows and high water temperatures. From Mesa Dam to an impassable falls there were 1,800 square yards of suitable spawning area, constituting approximately 3 percent of the total bottom in that area, and available only at high water.

There were 8 irrigation diversions on the stream, the most important being the Mesa ditch, located about 8 miles above the mouth. This diversion has a legal right to all the water in the stream during the irrigation season. It is also the source of domestic water supply for the town of Mesa. On the date of observation the Mesa ditch was withdrawing 48 c.f.s. It was reported that the stream bed is often practically dry below the diversion point during part of July, August, and September. The diversion dam is a wooden structure extending 32 feet downstream in a series of three low, broad steps. It is a barrier to fish at low water.

There is a falls 25 feet in height located about 13 miles above the mouth. It is a total barrier to fish.

Good runs of chinook salmon and steelhead formerly entered the Middle Fork. The stream is of no present or potential value to migratory fish because of the extensive withdrawal of water for agricultural and domestic use.

2P-(1). Fall Creek.-- (August 21, 1941; Frey and Bryant.) Fall Creek enters the Middle Fork of the Weiser River approximately 7 miles above the mouth. The stream is about 6 miles long, and has two important irrigation diversions. All the water from the upper part of the stream is diverted into the North Fork of Grays Creek, a tributary of the Little Weiser River, and is used to irrigate land in the vicinity of Indian Valley. Two miles above the mouth another diversion carries the remainder of the stream into the Mesa Ditch. Fall Creek is of no present or potential value to salmon because of its extensive agricultural use.

2Q. Cottonwood Creek.-- (Not surveyed.) Cottonwood Creek enters the Weiser River approximately 52 miles above the mouth. The stream is about 11 miles long. There were six irrigation diversions on the main stream and one on 2Q-(1) North Cottonwood Creek. There were no reports of salmon entering the stream in recent years. Because of the extensive withdrawal of water for irrigation and the hazards to fish presented by the unscreened diversions, Cottonwood Creek was considered of no value to salmon and of only slight value to steelhead.

2R. Hornet Creek.-- (August 16, 1941; Frey and Bryant.) Hornet Creek enters the Weiser River approximately 54½ miles above the mouth. The main stream is about 18 miles long. Gaging-station records for

the water-year 1940-41 (U.S.G.S., 1942), taken at a station 2¼ miles above the mouth, show discharges ranging from a maximum of 527 c.f.s. in March to a minimum of 0.4 c.f.s. in July. On the date of observation the discharge at this point was 5.5 c.f.s. and the water temperature was 80°F. The gradient is moderate. 2R-(1) North Hornet Creek enters the main stream about 8 miles above the mouth and extends for 12 miles. 2R-(1)a The Left Fork enters North Hornet Creek 4½ miles above the mouth of the latter and extends for 7 miles to its source in constant springs. There were 13 irrigation diversions on Hornet Creek. Three of these were of fair size, each withdrawing 3-4 c.f.s. The stream was reported to have formerly supported good runs of chinook salmon and steelhead trout. The headwaters are still of some value to steelheads, although the irrigation diversions present hazards to downstream migrants. Because of the extensive withdrawal of water for irrigation, Hornet Creek is of no present or potential value to salmon.

2S. Mill Creek.— (Not surveyed.) Mill Creek enters the Weiser River approximately 58 miles above the mouth. The stream is about 7 miles long. There were nine irrigation diversions. There were no reports of salmon entering the stream in recent years. Because of its small size and use for irrigation, Mill Creek is of no value to salmon.

2T. Fort Hall Creek.— (Not surveyed.) Fort Hall Creek enters the Weiser River approximately 60 miles above the mouth. It is a very small stream, about 3 miles long. There were three irrigation diversions. There were no reports of salmon entering the stream. Because of its small size and use for irrigation, Fort Hall Creek is of no value to salmon.

2U. West Fork, Weiser River.— (August 29, 1941; Frey and Bryant.) The West Fork enters the Weiser River approximately 61 miles above the mouth. The stream is about 14 miles long. Gaging-station records for the water-year 1940-41 (U.S.G.S.,1942), taken at a station 1½ miles above the mouth, show discharges ranging from a maximum of 350 c.f.s. in April to a minimum of 2 c.f.s. in July. On the date of observation the discharge at this point was 46 c.f.s. There were three irrigation diversions on the stream, the largest withdrawing about 6 c.f.s. The West Fork was reported to have formerly supported good runs of chinook salmon and steelhead trout, and it is still of some value for steelhead. The chinook run has been greatly depleted, and the stream is of little present or potential value for salmon because of the extensive withdrawal of water for irrigation.

2U-(1). Lost Creek.— (August 29, 1941; Frey and Bryant.) Lost Creek enters the West Fork of the Weiser River approximately 8 miles above the mouth. The stream is about 21 miles long. Gaging-station records for the water-year 1940-41 (U.S.G.S., 1942), taken at a point ¼ mile below the Lost Valley reservoir dam, or about 10 miles above the mouth, show discharges ranging from a maximum of 184 c.f.s. in May to a minimum of 2 c.f.s. in October. On the date of observation the discharge at this point was about 49 c.f.s. There was very little discharge from October through March, when water was being impounded.

The Lost Valley reservoir dam is about 40 feet high and 300 feet long. The regulated discharge occurs through outlet gates at the base. A spillway is located at one end of the structure. No fishways are provided and the dam is a total barrier to fish. The reservoir is used to provide sufficient water for irrigation diversions on the West Fork and the main Weiser River above Crane Creek during July, August, and September. Practically the entire discharge from the reservoir is thus diverted during the irrigation season. Although there are no water diversions on Lost Creek itself, it is of no present or potential value to salmon because the flow is used for irrigation during the summer and impounded during the winter.

2V. Warm Spring Creek.-- (Not surveyed.) Warm Spring Creek enters the Weiser River approximately 64 miles above the mouth. It is a small stream, about 7 miles long.

There is an impassable dam below Starkey Hot Springs, about 1 mile above the mouth. The stream is of no value to salmon.

2W. East Fork, Weiser River.-- (Not surveyed.) The East Fork enters the Weiser River approximately 68½ miles above the mouth. The stream is about 14 miles long. Gaging-station records are not complete, but readings for the year 1941 (U.S.G.S., 1942), taken at a point about 12 miles above the mouth, show discharges ranging from a minimum of 0.5 c.f.s. in April to a maximum of 45 c.f.s. in May. There is probably no flow at times during the winter. There were two irrigation diversions on the stream. Most of the water in the upper part was being used for irrigation in the vicinity of Council. The East Fork was reported to have formerly supported runs of chinook salmon and steelhead. It is of no present value to salmon because of the withdrawal of water for irrigation.

2X. Beaver Creek.-- (Not surveyed.) Beaver Creek enters the Weiser River approximately 74 miles above the mouth. It is a small stream, about 7 miles long. There were no reports of salmon entering Beaver Creek, and it is of little value to migratory fish.

2Y. East Branch, Weiser River.-- (Not surveyed.) The East Branch enters the head of the Weiser River at a point approximately 82 miles above the mouth. It is a small stream, about 7 miles long. During the irrigation season some water is diverted from Boulder Creek in the Little Salmon River system and carried into the East Branch of the Weiser. There were no reports of salmon entering the East Branch, and it is of little value to migratory fish.

2Z. West Branch, Weiser River.-- (Not surveyed.) The West Branch joins the East Branch to form the main Weiser River at a point approximately 82 miles above the mouth of the latter. It is

a small stream, about 3 miles long. The discharge is very low except during spring freshets. There were no reports of salmon entering the stream, and it is of little value to migratory fish.

Summary of Recommendations

The large amount of good spawning area in the headwaters of the Weiser River System, and the survival of a fair run of steelhead trout under adverse conditions indicates the great potential value of the system to this species. Therefore, all diversions should be screened and streams should be improved to facilitate upstream passage of fish.

As long as the present extensive agricultural use of the system's water is continued, it is useless to attempt to restore the run of chinook salmon, since the time of spawning migration corresponds with the period of maximum irrigation use.

*

Table of Obstructions and Diversions

Name of stream	Name of obstruction or diversion	Height in feet		Diversion	Protective Devices	
		Falls	Dams	(c.f.s.)	Present	Needed
Weiser River	Mill Ditch			9	None	Screen
Weiser River	Galloway		4	240	Fishway	Needs alteration and screen.
Weiser River	Middle Valley			60		Screen
Weiser River	Robertson-Levey			30		Screen
Weiser River	Sunnyside			30		Screen
Weiser River	Allison-Jewell			9		Screen
Crane Creek	Crane Creek Dam		High		None	Not feasible
Middle Fork, Weiser R.	Mesa Dam		5	0-50	None	Fishway and screen
Middle Fork, Weiser R.	Falls	25			None	Not feasible
Lost Creek	Lost Valley Dam		40		None	Not feasible

* This tabulation includes only those obstructions and diversions which would seriously interfere with runs of salmon and steelhead in the stream.

PART 3

SUB-AREA PAYETTE RIVER SYSTEM

CONTENTS

	Page
Introduction	47
List of Streams	49
The Survey	50
Summary of Recommendations	59
Table of Obstructions and Diversions	60

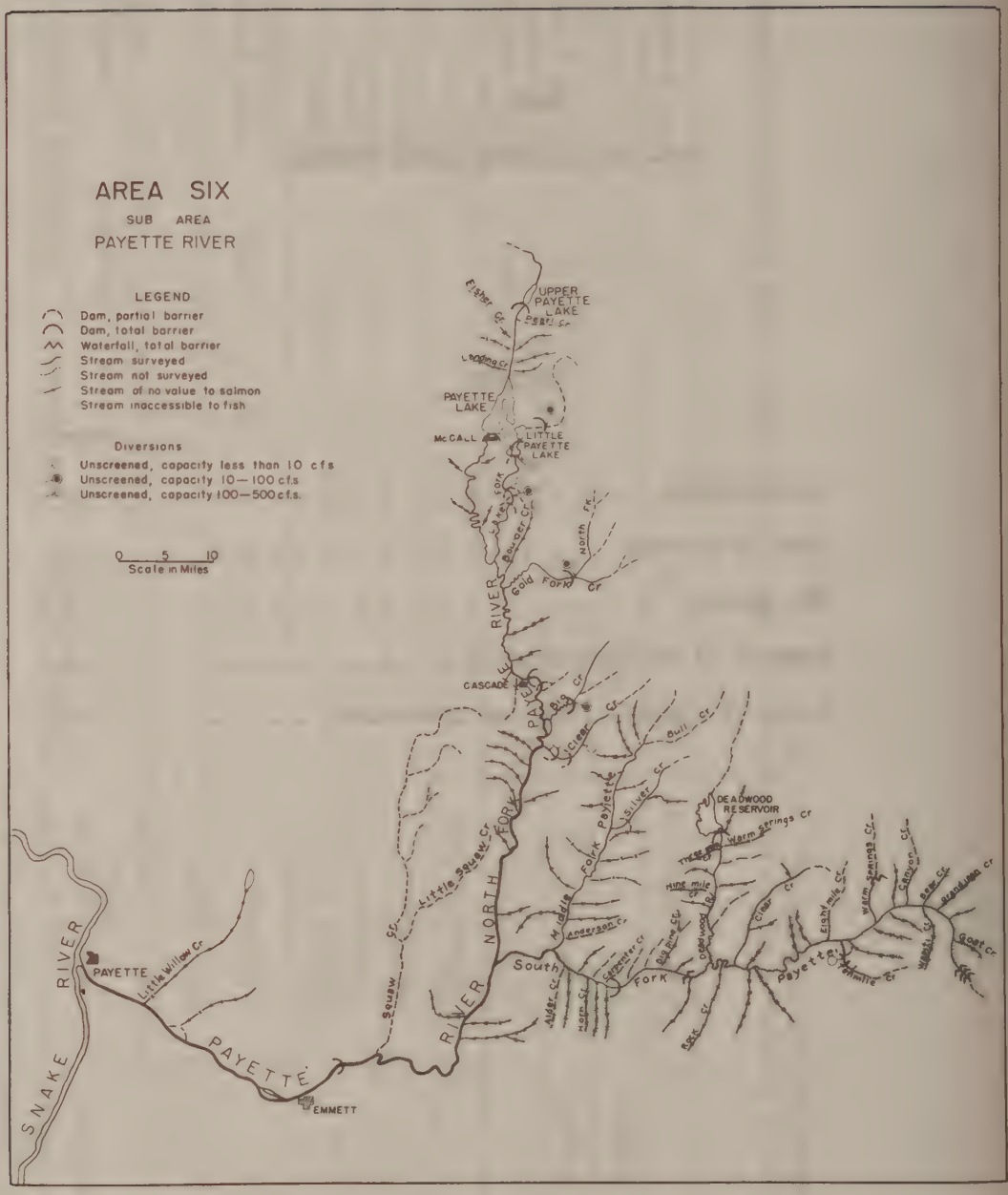


Figure 5. Payette River System

Introduction

The Payette River joins the Snake River approximately 357 miles above the Columbia River confluence. Its drainage area comprises approximately 3500 square miles of west-central Idaho, and includes a portion of the western slope of the Sawtooth Mountains. The total stream length of the entire river system, including all streams large enough to accommodate salmon, is approximately 400 miles. There are three lakes in the headwaters. The largest of these is Payette Lake, and the others are known as Upper Payette Lake and Little Payette Lake.

The Payette River System was formerly a very important and valuable area for natural salmon reproduction. Large runs of chinook salmon utilized the spawning area in the main stream as well as in the principal tributaries. However, its most valuable asset was the large amount of spawning and rearing area provided by the lakes in its headwaters for the large runs of blueback salmon that the system formerly supported. The early day importance of this area for blueback salmon was pointed out by Evermann (1896, 1897).

The blueback runs in this system were exterminated many years ago and the chinook runs have somewhat more recently met the same fate. The depletion of the salmon runs in the Payette began at an early date. Old residents agree that at least 35 years ago a former diversion dam located a few miles below Horseshoe Bend prevented salmon from passing upstream above that point, thus blocking the entire run of bluebacks from the headwater lakes and confining the chinook run to the main stream below the dam. For the ensuing 15 years the chief chinook spawning areas were located near Montour and the mouth of Squaw Creek. When the Black Canyon Dam was built these spawning areas were rendered inaccessible. The dam at Horseshoe Bend was later removed. A steadily diminishing congregation of chinook salmon has been reported to have occurred at the Black Canyon Power Plant in former years, but no salmon have been reported at this point since 1937, when only two were seen.

A short time before the outbreak of World War II the U. S. Bureau of Reclamation started the construction of a dam on the north fork of the Payette River at Cascade, Idaho, for the purpose of water storage in connection with the Boise Project. Work at this point was discontinued for the duration of the war, but the project has since been completed. No fish passage facilities were provided.

Also authorized for the Boise Project, but not yet built, is a diversion dam at Smith Ferry, about 15 miles below the Cascade Dam. The diversion would take almost the entire flow of the North Fork at this point. The water would flow through a tunnel and two power plants before entering a storage reservoir to be built on the south fork of the Payette in the vicinity of Garden Valley. Another tunnel would lead from the Garden Valley reservoir to the Boise River watershed, where additional land would thus be placed under irrigation.

List of Streams

	Page
3. Main Payette River	50
A. Little Willow Creek	50
B. Willow Creek	50
C. Squaw Creek	52
D. Jerusalem Creek	52
E. Hill Creek	52
F. Brownlee Creek	52
G. North Fork, Payette River	52
(1) Clear Creek	54
(2) Big Creek	54
(3) Gold Fork Creek	54
a. North Fork, Gold Creek	55
(4) Lake Fork Creek	55
a. North Fork, Lake Creek	56
H. South Fork, Payette River	56
(1) Middle Fork, Payette River	57
a. Silver Creek	57
(2) Deadwood River	57
(3) Clear Creek	58
(4) Eightmile Creek	58
(5) Tenmile Creek	58
(6) Warm Spring Creek	58
(7) Canyon Creek	59

3. Main Payette River.— (August 1-5, 1938; Hanavan, Parkhurst, Wilding, and Morton.) The main Payette River is approximately 72 miles long. The discharge at the mouth is subject to great variation, being dependent upon the amount of water impounded and diverted for irrigation. Gaging-station records for the water-year 1940-41 (U.S.G.S.,1942), taken at a station a short distance above the mouth, show discharges ranging from a maximum of 9,700 c.f.s. in May and June to a minimum of 469 c.f.s. in August. The stream is available to migratory fish for a distance of about 41 miles above the mouth. The average water temperature in this section at the time of the survey was 74.0 F. Such high water temperatures during late summer render the available portion of the stream of little value to salmon.

The Black Canyon Dam was constructed in 1923 by the U.S. Bureau of Reclamation as a power and irrigation project. This dam is 96 feet high, and is a total barrier to migratory fish. There were no fish-protective devices at the time of the survey, but the U.S.Fish and Wildlife Service has since screened the irrigation diversion. The power diversion remains unscreened. The U.S. Fish and Wildlife Service has reported that it would be possible to construct some type of fishway over the dam, but only at a high cost - probably more than $200,000.

There were elevan irrigation diversions and one power diversion in operation on the main Payette. None of these were screened at the time of the survey. Eight diversions were of large size.

Sewage is discharged into the stream at the town of Payette near the mouth, and at Emmett, about 32 miles above the mouth. Sawmill waste also enters at Emmett. The lower portion of the stream bed is heavily silted in many places.

The main Payette formerly supported a good run of chinook salmon and provided a passageway for a good run of blueback salmon. It is of no value to migratory fish at present.

3A. Little Willow Creek.— (Not surveyed.) Little Willow Creek enters the Payette River approximately 9 miles above the mouth. It is a small, intermittent stream about 23 miles long. The Paddock Valley reservoir is located about 18 miles above the mouth. The stream is of no value to salmon.

3B. Willow Creek.— (Not surveyed.) Willow Creek enters the Payette River through several ditches approximately 13 miles above the mouth. The stream is about 23 miles long. Because of its agricultural use Willow Creek is of no value to salmon.

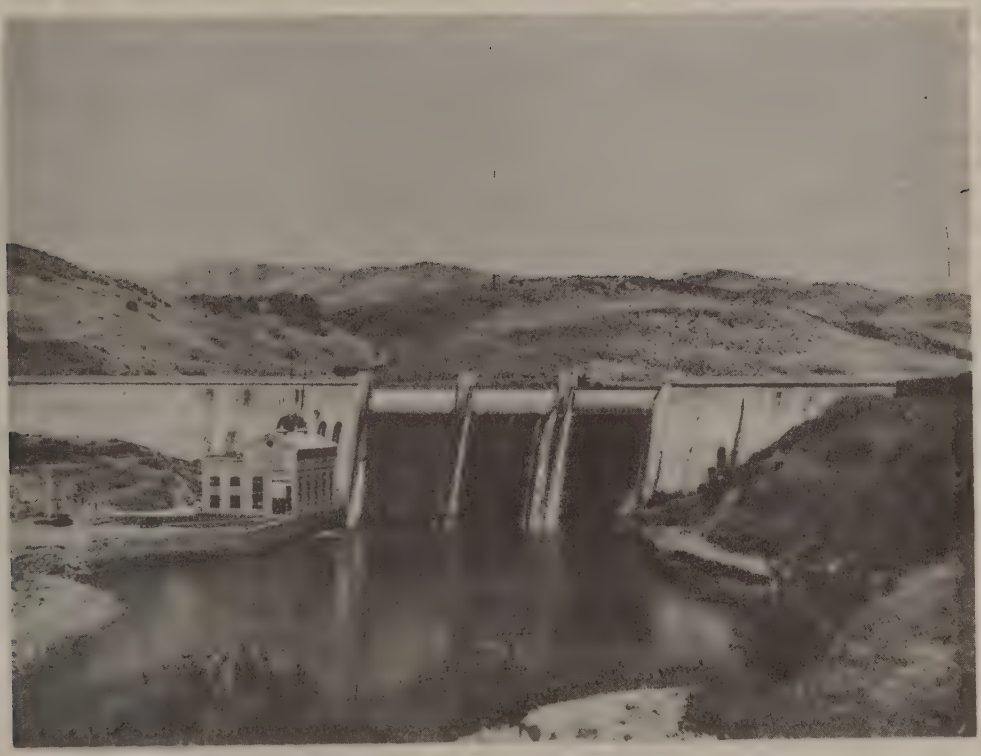


Figure 6.-- Black Canyon Dam, Payette River

3C. Squaw Creek.-- (Not surveyed.) Squaw Creek enters the Payette River approximately 45 miles above the mouth. The stream is about 45 miles long. It is of no value to salmon because it enters above Black Canyon Dam, and almost the entire flow is diverted for irrigation.

3D. Jerusalem Creek.-- (Not surveyed.)

3E. Hill Creek.-- (Not surveyed.)

3F. Brownlee Creek.-- (Not surveyed.) These are all small, intermittent streams entering the Payette River between Squaw Creek and the north fork of the Payette. None of them are of any potential value to salmon.

3G. North Fork, Payette River.-- (August 5-13, 1938; Hanavan, Parkhurst, Wilding, and Morton.) The North Fork enters the Payette River approximately 72 miles above the mouth. The stream is about 120 miles long, of which 116 miles were surveyed. The average stream width from the mouth to Payette Lake was more than 180 feet. The discharge at the time of the survey was 573 c.f.s. at a point about 40 miles above the mouth, about 300 c.f.s. at the outlet of Payette Lake, and about 75 c.f.s. at a point 4 miles above Payette Lake. The water temperature was 69.0 F. at the mouth, 67.0 F. at the outlet of Payette Lake, and 53.0F. at the upper end of Upper Payette Lake. The gradient is mostly moderate. There is a concentration of good spawning area for a distance of 12 miles downstream from the outlet of Payette Lake, and also in the section between Payette and Upper Payette Lakes. There were 310,000 square yards of suitable spawning area, constituting approximately 4 percent of the total bottom in the surveyed portion of the stream.

There is a mill dam at the town of Cascade, about 40 miles above the mouth. This obstruction is 4 feet high, has no fish ladder, and is passable only at high water.

There is a power dam located one mile above the town of Cascade. This obstruction is 7 feet high, has no fish ladder, and is impassable to fish. The power diversion is unscreened.

A new water control dam was constructed at the outlet of Payette Lake in the fall of 1943. It was designed to raise the level of the lake about 7 or 8 feet, and probably withstands a head at the dam of about 10 feet. No fishways were provided, and the dam is a barrier to migratory fish.

There is a water control dam at the outlet of Upper Payette Lake. This obstruction is about 9 feet high, has no fish ladder, and is impassable to fish.

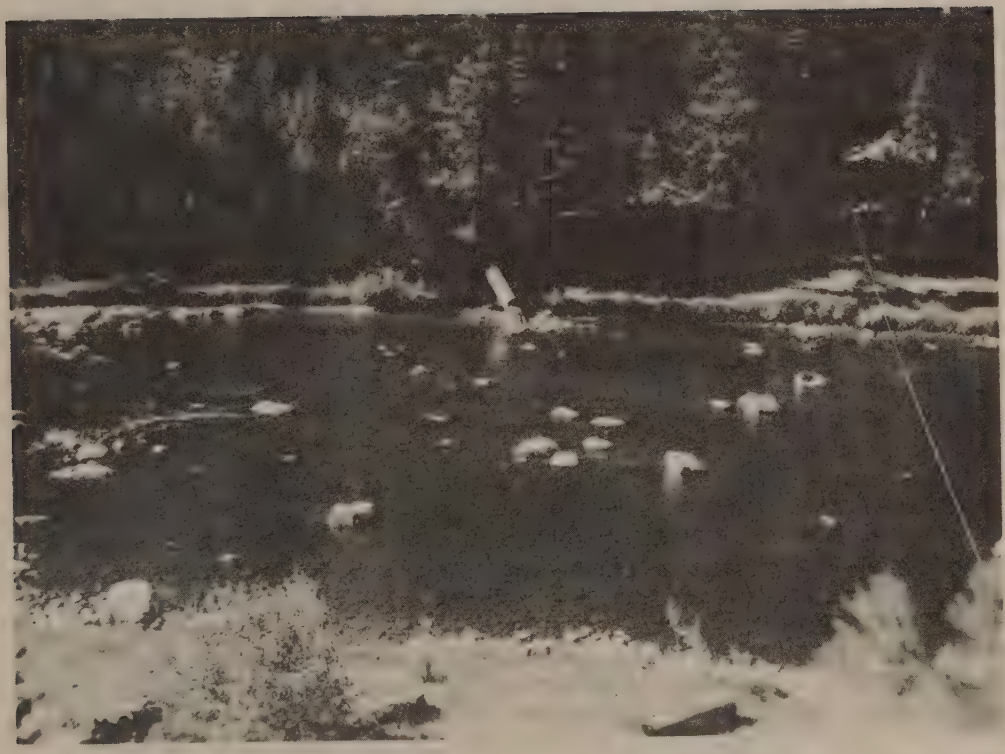


Figure 7.-- North Fork of Payette River below Payette Lake, to show suitable salmon spawning area.

There is a small diversion about 500 yards below the outlet of Payette Lake which provides water for a fish hatchery.

Untreated sewage from the town of McCall is discharged into the stream about a half mile downstream from the outlet of Payette Lake, but pollution is not extensive.

The North Fork together with the lakes in its headwaters formerly supported large runs of chinook and blueback salmon. Payette Lake still has a large population of land-locked blueback salmon, called "Little Redfish". This region is now completely inaccessible and of no present value to salmon.

3G-(1). Clear Creek.— (August 19, 1938; Parkhurst and Morton.) Clear Creek enters the North Fork of the Payette approximately 29 miles above the mouth. The stream is about 16 miles long, of which 6 miles were surveyed. It is of no possible value above the terminus of the survey because of its small size and steep gradient. It was 12 feet wide at the mouth and discharging about 10 c.f.s. The water temperature was 54.0F. The gradient is mostly slight, but becomes fairly steep in the upper section. There is little spawning area, the stream bed being composed chiefly of sand. There were 2,100 square yards of suitable spawning area, constituting approximately 4 percent of the total bottom in the portion surveyed. Several beaver dams in the lower section were barriers to fish. There were two small, unimportant, unscreened diversions for irrigation and stock watering. The stream has a large population of rough fish. It is completely inaccessible, and of little potential value to migratory fish.

3G-(2). Big Creek.— (August 18, 1938; Parkhurst and Morton.) Big Creek enters the North fork of the Payette approximately 32 miles above the mouth. The stream is about 19 miles long, of which 4 miles were surveyed. It was 18 feet wide at the mouth and discharging about 30 c.f.s. The water temperature was 64.0 F. The gradient is slight. There was no suitable salmon spawning area in the section surveyed, the stream bed being composed almost entirely of sand. A series of beaver dams and log jams were considered impassable to fish at low water. There is an irrigation diversion dam located at the terminus of the survey. This obstruction is 25 feet high, has no fishway, and is a total barrier to fish. About 15 c.f.s. were being diverted into an unscreened ditch. The stream is completely inaccessible, and of no present or potential value to migratory fish.

3G-(3). Gold Fork Creek.— (August 17, 1938; Hanavan, Parkhurst, Wilding, and Morton.) Gold Fork Creek enters the North Fork of the Payette approximately 58 miles above the mouth. It is about 28 miles long, of which 19 miles were surveyed. The stream divides into four or five small branches above the terminus of the survey. In the lower part it had an average width of 24 feet, and was discharging

40 c.f.s. The water temperature was 58.0 F. The gradient is slight to moderate. The stream bed contains large amounts of sand and silt. There were 23,000 square yards of suitable spawning area, constituting approximately 7 percent of the total bottom in the portion surveyed. There is an irrigation diversion dam located 12 miles above the mouth. This obstruction is 15 feet high, has no fishway, and is impassable to fish. During the irrigation season 30-40 c.f.s. are diverted into an unscreened ditch. Part of this diversion is returned 4 miles below the dam, but the intervening portion of the stream bed is rendered almost dry. The stream is completely inaccessible, and has little potential value for migratory fish.

3G-(3)a. North Fork, Gold Fork Creek.-- (August 17, 1938; Wilding.) The North Fork enters Gold Fork Creek about a half mile above the impassable dam, or approximately 12½ miles above the mouth. The stream is about 14 miles long, of which 7 miles were surveyed. It is of no possible value to salmon above the terminus of the survey because of the steep gradient. It was 30 feet wide at the mouth and discharging about 20 c.f.s. The water temperature was 47.0 F. at the terminus of the survey. The gradient is moderate in the portion surveyed. There were 53,000 square yards of suitable spawning area, constituting approximately 45 percent of the total bottom in the portion surveyed. The stream is completely inaccessible. It is of no present value, but has good potential value for salmon.

3G-(4). Lake Fork Creek.-- (August 15, 1938; Hanavan, Parkhurst, Wilding, and Morton.) Lake Fork Creek enters the North Fork of the Payette approximately 64 miles above the mouth. The stream is about 24 miles long, of which the upper 20 miles were surveyed. The first 4 miles were not surveyed because in this section the stream is sluggish, and the bottom is composed entirely of sand with no possible salmon spawning area. The discharge was about 10 c.f.s. at the mouth and 220 c.f.s. at the outlet of Little Payette Lake. The water temperature was 62-65.0 F. The gradient is slight to moderate. There is a concentration of good spawning area in the upper 6½ miles. There were 57,000 square yards of suitable spawning area constituting approximately 15 percent of the total bottom in the portion surveyed.

A dam 2 feet in height is located 16½ miles above the mouth, and is a barrier at low water.

An irrigation diversion dam 2 feet in height is located 17½ miles above the mouth, diverts 70 c.f.s., and is a barrier at low water.

An irrigation wing dam located 18½ miles above the mouth diverts 5-6 c.f.s.

An irrigation diversion dam 2 feet in height is located 22½ miles above the mouth, diverts 144 c.f.s. with the addition of flash boards, and is a barrier at low water.

The water control dam at the outlet of Little Payette Lake is 15 feet high, and is impassable to fish.

None of these dams or diversions were equipped with any fish-protective devices.

A run of blueback salmon formerly entered Little Payette Lake. It was reported that the lake now supports a population of the land-locked form of the same species. Lake Fork Creek is completely inaccessible to salmon, and is of little potential value because during the irrigation season 90 percent of the flow is diverted for agricultural use.

3G-(4)a. North Fork, Lake Fork Creek.— (August 14, 1938; Hanavan.) The North Fork enters the upper end of Little Payette Lake. The stream is about 14 miles long. An impassable power dam 20 feet in height is located 2 miles above the lake. The diversion of 20 c.f.s. was being carried to the power plant one mile below, where it was returned to the stream. There were no fish-protective devices. The stream bed from the dam to the power plant is practically dry at low-water stages. The North Fork is completely inaccessible, and of no present value to salmon.

3H. South Fork, Payette River.— (August 21-25, 1938; Hanavan, Parkhurst, Wilding, and Morton.) The South Fork enters the Payette River approximately 72 miles above the mouth. The stream is about 77 miles long, of which 73 miles were surveyed. Near the mouth it was about 100 feet wide. Gaging-station records taken at a station 1 mile above the mouth (U.S.G.S., 1939) show a discharge of 1200 c.f.s. at the time of the survey. The discharge of the lower South Fork is partly controlled by the operation of a dam on the Deadwood River. The water temperature ranged from 69.0 F. at the mouth to 54.0 F. at the terminus of the survey. The gradient is mostly moderate, but is fairly steep in some places. There is a concentration of good spawning area for a distance of 7 miles above the confluence of the Middle Fork. This portion of the stream provided the principal chinook salmon spawning area in the South Fork before the run was blocked by dams in the main Payette. There were 410,000 square yards of suitable spawning area, constituting approximately 11 percent of the total bottom in the portion surveyed; 200,000 square yards or approximately 49 percent of the spawning area, was found in the lower 16 miles, below the impassable Grimes Pass power dam.

The Grimes Pass power dam, located about 16 miles above the mouth, was 60 feet high and was not provided with any means for the passage of fish. The middle third of this structure was washed out on July 7, 1943. It was reported that reconstruction was intended.

There is a series of natural falls about 25 miles above the mouth. One of these is about 15 feet high, and it was reported that when salmon were formerly able to enter the South Fork they did not ascend above this point.

There is an impassable series of steep cascades and low falls extending for a distance of a half mile above the terminus of the survey.

The lower portion of the South Fork formerly supported a good run of chinook salmon, and still has good potential value as a salmon producer. The area above the Grimes Pass dam is of slight potential value. The entire stream is now inaccessible to migratory fish.

3H-(1). Middle Fork, Payette River.-- (August 23-24, 1938; Hanavan and Wilding.) The Middle Fork enters the South Fork of the Payette approximately 7 miles above the mouth. The stream is about 40 miles long, of which 32 miles were surveyed. It is of little possible value to salmon above the terminus of the survey because of the steep gradient and lack of spawning area. Near the mouth the stream was about 50 feet wide and discharging about 150 c.f.s. The water temperature ranged from 70.0 F. at the mouth to 58.0 F. at the terminus of the survey. The gradient is slight to moderate, and increases upstream. Some good spawning area was found in the upper 22 miles of the portion surveyed. Floods have deposited large amounts of sand and silt throughout much of the stream bed, thus damaging many former good spawning areas. There were 89,000 square yards of suitable spawning area, constituting approximately 9 percent of the total bottom in the portion surveyed. The Middle Fork was reported to have formerly supported a large run of chinook salmon, and it still has good potential value as a salmon producer. The entire stream is now inaccessible to migratory fish.

3H-(1)a. Silver Creek.-- (August 31, 1938; Parkhurst and Morton.) Silver Creek enters the Middle Fork of the Payette approximately 18 miles above the mouth. The stream is about 15 miles long, of which 9½ miles were surveyed. It is of no possible value to salmon above the terminus of the survey because of its small size and steep gradient. The stream was 25 feet wide at the mouth, discharging about 50 c.f.s., and the water temperature was 58.0 F. The gradient is moderate to steep, and there is only 1,000 square yards of suitable spawning area, constituting approximately one percent of the total bottom in the portion surveyed. Several beaver dams and log jams were found to be impassable at low water. It was reported that a few chinook salmon formerly entered Silver Creek, but the stream was considered to be of little potential value to salmon. The entire stream is now inaccessible to migratory fish.

3H-(2). Deadwood River.-- (August 29, 1938; Hanavan, Parkhurst, Wilding, and Morton.) The Deadwood River enters the South Fork of the Payette approximately 30 miles above the mouth. It is about 40 miles long, of which 14 miles were surveyed. The stream was about 100 feet wide just above the mouth, and gaging-station records taken at this point (U.S.G.S.,1939) show a discharge of 193 c.f.s. on the date of the

survey. The discharge is largely controlled by the Deadwood Dam, and ranges from less than 50 c.f.s. when water is being impounded to more than 2,000 c.f.s. during the period of maximum irrigation use in the lower Payette Valley. Nine miles above the mouth a steep box canyon was encountered which extended 6 miles and could not be traversed. The gradient is fairly steep in the lower part, but becomes moderate in the 5 miles immediately below the dam, where the only good spawning area was found. There were 11,000 square yards of suitable spawning area, constituting approximately 2 percent of the total bottom in the portions surveyed. The Deadwood Dam is located about 23 miles above the mouth. It is 120 feet high, and is not equipped with fishways. The survey was terminated at this point. There are no records of any salmon runs in the Deadwood or any other tributaries of the South Fork of the Payette above the impassable falls on the latter. The Deadwood River is completely inaccessible, and of no present or potential value to salmon.

3H-(3). Clear Creek.— (August 25-26, 1938; Hanavan and Wilding.) Clear Creek enters the South Fork of the Payette approximately 34 miles above the mouth. The stream is about 20 miles long, of which 15½ miles were surveyed. It is of no possible value to salmon above the terminus of the survey because of its small size and steep gradient. Near the mouth the stream was 33 feet wide, discharging about 40 c.f.s., and the water temperature was 62.0 F. The gradient is steep throughout. There were only 4,100 square yards of suitable spawning area, constituting less than 2 percent of the total bottom in the portion surveyed. Clear Creek is completely inaccessible, and of little potential value to salmon.

3H-(4). Eightmile Creek.— (August 27, 1938; Parkhurst.) Eightmile Creek enters the South Fork of the Payette approximately 48 miles above the mouth. The stream is about 10 miles long, of which 2½ miles were surveyed. It is of no possible value to salmon above the terminus of the survey because of the steep gradient. Near the mouth the stream was 20 feet wide, discharging about 25 c.f.s., and the water temperature was 49.0 F. The gradient is moderate to steep. There were only 1,700 square yards of suitable spawning area, constituting approximately 6 percent of the total bottom in the portion surveyed. Eightmile Creek is completely inaccessible, and of little potential value to salmon.

3H-(5). Tenmile Creek.— (August 27, 1938; Morton.) Tenmile Creek enters the South Fork of the Payette approximately 50 miles above the mouth. The stream is about 13 miles long, of which 3 miles were surveyed. It is of no possible value to salmon above the terminus of the survey because of the steep gradient. Near the mouth the stream was 30 feet wide, discharging about 30 c.f.s., and the water temperature was 51.0 F. The gradient is steep throughout, and there is practically no suitable spawning area. A dam 2 feet in height is located about 2 miles above the mouth, and diverts 5-8 c.f.s. into an unscreened irrigation ditch. Tenmile Creek is completely inaccessible, and of no present or potential value to salmon.

3H-(6). Warm Spring Creek.— (August 27, 1938; Hanavan.) Warm Spring Creek enters the South Fork of the Payette approximately 55 miles above the mouth. The stream is about 9 miles long, of which 2 miles were surveyed. It is of no possible value to salmon above

the terminus of the survey because of a series of falls and the extremely steep gradient. Near the mouth the stream was about 30 feet wide, discharging about 75 c.f.s., and the water temperature was 55.0 F. The gradient is steep throughout, and there is practically no suitable spawning area. Warm Spring Creek is completely inaccessible, and of no present or potential value to salmon.

3H-(7). Canyon Creek.-- (August 26, 1938; Wilding.) Canyon Creek enters the South Fork of the Payette approximately 58 miles above the mouth. The stream is about 9 miles long, of which 2 miles were surveyed. It is of no possible value to salmon above the terminus of the survey because of the extremely steep gradient. Near the mouth the stream was 18 feet wide and discharging about 25 c.f.s. The gradient is steep throughout, and there is practically no suitable spawning area. Canyon Creek is completely inaccessible, and of no present or potential value to salmon.

Summary of Recommendations

The completion of the Boise Project as presently contemplated would render the restoration of the chinook and blueback salmon runs of the Payette River not only very costly but also doubtful of success. The construction of fishways at Black Canyon Dam would be of little benefit unless adequate facilities were provided at Smith Ferry, Cascade, and the Payette Lakes. A number of large diversions would have to be screened and there also would be the problem of maintaining adequate stream flows at the time of salmon migration. No fish protective devices or stream improvements are recommended for this system because it is felt that efforts at salmon conservation would be more effective in certain other localities.

TABLE OF OBSTRUCTIONS AND DIVERSIONS

Name of Stream	Name of Obstruction or Diversion	Height in Feet		Diversion in c.f.s.	Protective Devices	
		Falls	Dams		Present	Needed
1/ Payette River	Last Chance Canal			40	None	Not recommended
" "	Bilbry Canal			12	None	" "
" "	Co-op. Canal			300	None	" "
" "	Enterprise Canal			30	None	" "
" "	Payette Valley Canal			200	None	" "
" "	Lower Payette Canal			144	None	" "
" "	Black Canyon Dam		96		None	" "
" "	Black Canyon Canal			790	Screened	" "
" "	Black Canyon Power			700	None	" "
North Fork, Payette R.	Cascade Mill Dam		4		None	" "
" " "	Cascade Power Dam		7		None	" "
" " "	Payette Lake Control Dam		10		None	" "
" " "	Upper Payette Control Dam		9		None	" "
Big Creek	Diversion Dam		25	15	None	" "
Gold Fork Creek	Diversion Dam		15	30-40	None	" "
Lake Fork Creek	Irrigation Diversion		Low	70	None	" "
" " "	Irrigation Diversion		Low	144	None	" "
" " "	Little Payette Control Dam		15		None	" "
No.Fork,Lake Fork Cr.	Power Dam		20	20	None	" "
So.Fork,Layette R.	Grimes Pass Power Dam		60		None	" "
" " " "	Falls	15			None	" "
Deadwood River	Storage and control dam		120		None	" "

* This tabulation includes only those obstructions and diversions which would seriously interfere with runs of salmon and steelhead in the stream.

PART 4

AREA VI EXCLUSIVE OF SUB-AREAS

CONTENTS

	Page
Introduction	63
List of Streams	64
The Survey	68
Summary of Recommendations	91
Table of Obstructions and Diversions	92

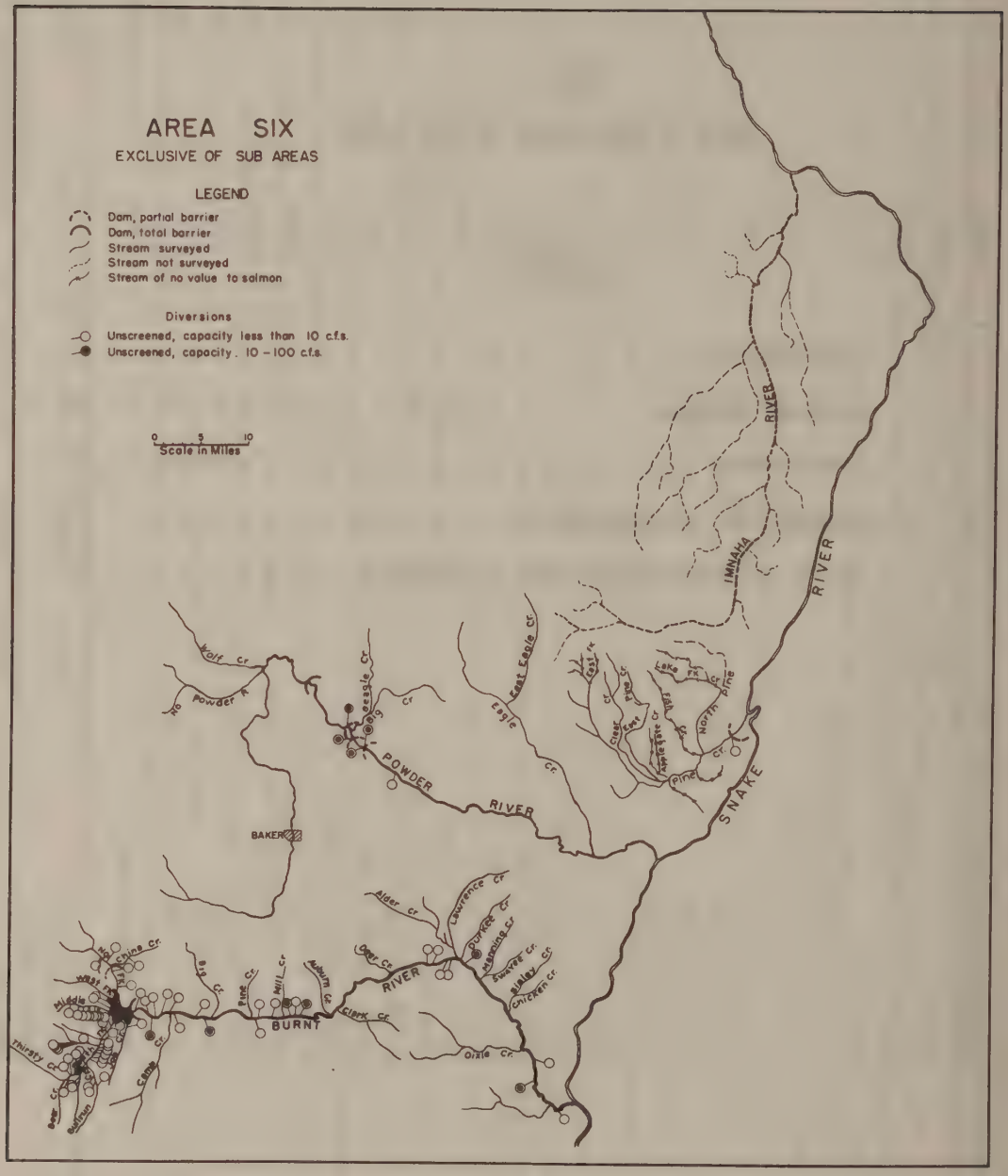


Figure 8. Area VI exclusive of Sub-Areas

Introduction

With the exception of the Immaha River, there are no streams of present or potential major importance to salmon on the Oregon side of the Snake River in this area. This is mainly due to extensive irrigation use, and the restoration of natural salmon production in this area would entail not only the screening of a great many irrigation diversions, but also the even greater difficulties of maintaining sufficient flows and proper water temperatures, and the construction of fishways over several large storage reservoir dams of fluctuating water level. Moreover, the salmon runs in this area are now in such a state of depletion that sufficient spawners are not available for the rehabilitation of the runs by means of artificial propagation. For these reasons the report on this section cannot hold forth much hope for restoration of salmon runs in streams other than the Immaha River.

List of Streams

	Page
4. Imnaha River	68
5. Pine Creek	68
A. North Pine Creek	70
(1) Lake Fork	70
B. Fish Creek	70
C. Fourmile Creek	70
D. Deer Creek	70
E. Applegate Creek	70
F. East Pine Creek	71
(1) Clear Creek	71
G. East Fork	71
H. West Fork	71
I. Middle Fork	71
6. Main Powder River	71
A. Daly Creek	76
B. Eagle Creek	76
(1) Skull Creek	77
(2) Little Eagle Creek	78
(3) Paddy Creek	78
(4) East Fork	78
(5) West Fork	78
C. Kirby Creek	78
D. Big Creek	78

List of Streams (continued)

Page

E. Wolf Creek 79

F. North Powder River 79

(1) Anthony Fork 80

(2) Antone Creek 81

(3) Dutch Flat Creek 81

G. Muddy Creek 81

H. Rock Creek 81

I. Pine Creek 81

J. Sutton Creek 82

K. Beaver Creek 82

L. Deer Creek 82

M. Cracker Creek 82

(1) Pole Creek 83

(2) Slim Creek 83

(3) Wind Creek 83

(4) Silver Creek 83

(5) Little Cracker Creek 83

N. McCully Fork 83

7. Main Burnt River 84

A. Durbin Creek 87

B. Marble Creek 87

C. Dixie Creek 87

D. Damen Jet Creek 87

List of Streams (continued)

	Page
E. Chicken Creek	87
(1) Sisley Creek	87
F. Shirttail Creek	87
G. Swayze Creek	87
(1) Manning Creek	87
H. Durkee Creek	87
I. Alder Creek	87
(1) Lawrence Creek	87
J. Powell Creek	87
K. Deer Creek	87
L. Dark Canyon Creek	87
M. Clarks Creek	87
N. Auburn Creek	87
O. Mill Creek	87
P. Pine Creek	87
Q. Independence Creek	87
R. Big Creek	87
(1) Cow Creek	87
S. Camp Creek	87
T. Job Creek	87
U. South Fork, Burnt River	88
(1) Pole Creek	88
(2) Bullrun Creek	88

List of Streams (continued)

		Page
(3)	Sheep Creek	89
(4)	Amelia Creek	89
(5)	Barney Creek	89
(6)	Elk Creek	89
	a. Last Chance Creek	89
(7)	Spring Creek	89
V.	Middle Fork, Burnt River	90
W.	West Fork, Burnt River	90
X.	North Fork, Burnt River	90
(1)	China Creek	90

4. Imaha River.-- (Not surveyed.) The Imnaha River joins the Snake River approximately 190 miles above the Columbia River confluence. Its drainage area comprises more than 900 square miles of northeastern Oregon in the Wallowa National Forest, and includes the eastern slope of the Wallowa Mountains. The stream is about 75 miles long. Gaging-station records for the water-year 1940-41 (U.S.G.S., 1942) give the mean discharge as 548 c.f.s. at Imnaha, 20 miles above the mouth. The stream flows through an extremely rugged, mountainous area, and has not been subjected to demands for water use by any agricultural or industrial development. The gradient is fairly steep throughout. Imnaha Falls is located about 65 miles above the mouth. This falls was reported to be a barrier to salmon. The Imnaha formerly supported good runs of chinook salmon and steelhead trout, but the present runs were reported to be very small.

5. Pine Creek.-- (July 17, 1942; Parkhurst.) Pine Creek joins the Snake River at Copperfield, Oregon, approximately 269 miles above the Columbia River confluence. Its drainage area comprises more than 300 square miles, and includes a portion of the southeastern slope of the Wallowa Mountains. The main stream is about 32 miles long. The greater part of its course lies adjacent to the southern boundary of the Minam Division of the Whitman National Forest. It was reported that no salmon have been seen in Pine Creek for about the past 15 years. A small winter and early spring run of steelhead trout still ascend to the upper part of the stream, and also enter a number of tributaries. The survival of the steelhead run has been possible because these fish enter during highwater periods, and are not subjected to adverse water conditions. Topographically the Pine Creek drainage basin may be divided into four sections: (1) Lower Pine Canyon; (2) Pine Valley; (3) Carson to Cornucopia, Oregon; and (4) Cornucopia to the headwaters.

Section (1) - Lower Pine Canyon:

Pine Creek extends through a narrow, rocky canyon from the mouth to a point about 12 miles upstream. The stream was 45 feet wide at the mouth, and was discharging about 90 c.f.s. The water temperature was 70.0 F. at the mouth. The gradient is fairly steep to moderate in this section, and there are numerous good shallow riffles and adequate resting pools. It was estimated that about 50 percent of the stream bed constituted suitable spawning area. However, the high water temperatures occurring in the late summer months would be an adverse factor to spawning salmon.

A diversion dam 2 feet in height is located approximately 3 miles above the mouth. There was a good flow over the crest of this structure, and it was not a barrier to fish. About 3 c.f.s. were being diverted into an unscreened ditch for irrigation and stock watering.

Section (2) - Pine Valley:

Above the lower canyon section the stream extends for the next 12 miles through Pine Valley to the town of Carson. In the lower half of this section the stream flows through a valley characterized by a series of low, rolling hillocks, which gradually recede as the valley becomes wider. The gradient is moderate, and gradually decreases upstream. The stream divides about 16 miles above the mouth, just above the village of Pine. The branch entering from the south side of the valley was discharging about 15 c.f.s., while the main stream above this point was flowing about 30 c.f.s. at the time of observation, and in many places did not fully cover the wide, shallow channel. The average width of the main stream was about 30 feet. There are numerous excellent shallow riffles throughout, and it was estimated that about 90 percent of the bottom constituted suitable salmon spawning area. There are few resting pools. In the upper half of this section the stream extends for a distance of 6 miles through a gently sloping valley one to two miles wide. This portion of the valley is extensively cultivated, and there are large numbers of small, unscreened irrigation diversions, which in late summer take practically all of the water in both the main stream and the side channel.

Section (3) - Carson to Cornucopia, Oregon:

Above Pine Valley the stream extends for the next 5 miles through a narrow valley 300-100 yards wide to the mining camp of Cornucopia. There is no cultivation in this section. There was no mining along the stream at the time of observation and, although there has been considerable such activity in the past, the stream has not been damaged. The gradient is moderate, increasing to fairly steep upstream. There are no obstructions or diversions in this portion of the stream. A side channel originates a mile above Carson, and was carrying about 30 c.f.s. down the south side of Pine Valley. The main stream was 39 feet wide and flowing about 90 c.f.s. at Cornucopia. The water temperature was 52.0 F. There are numerous excellent shallow riffles, and it was estimated that about 75 percent of the bottom constituted suitable salmon spawning area. Resting pools are adequate and of good quality, especially in the upper part of this section.

Section (4) - Cornucopia, Oregon to headwaters:

Above Cornucopia the main stream courses through a narrow rocky canyon for a distance of about 2½ miles. The gradient is steep, the stream being of the cascade type. At this point the main stream is formed by the confluence of the West Fork and the Middle Fork. The bottom contains a large amount of bedrock and

boulders, and is of little value as spawning area for salmon.

5A. North Pine Creek.— (July 17, 1942; Parkhurst.) North Pine Creek enters Pine Creek approximately 7 miles above the mouth. It is about 15 miles long. The stream had an average width of 10 feet and was discharging about 15 c.f.s. The water temperature at the mouth was 57.5 F. The gradient is steep, with numerous cascades and small falls flowing over large rubble and bedrock. It was estimated that less than 10 percent of the bottom constituted suitable salmon spawning area. The stream was considered passable to salmon in the lower 8 miles, up to the mouth of Lake Creek. Above this point it is too small and steep to be of value to salmon. There were no reports of salmon in North Pine Creek, and it is of little potential value for natural salmon production. It was reported that some steelhead ascend during the spring high-water period.

5A-(1). Lake Fork.— (Not surveyed.) Lake Fork enters North Pine Creek 8 miles above the mouth. It is about 12 miles long. A.U.S. Forest Service Guard reported that the stream is too small and steep to be of value to salmon.

5B. Fish Creek.— (July 18, 1942; Parkhurst.) Fish Creek enters Pine Creek approximately 7½ miles above the mouth. The stream extends for about 14 miles to its source in a high, mountain lake. Fish Creek had an average width of 6 feet and was discharging about 5 c.f.s. The water temperature at the mouth was 58.0 F. The gradient is steep, the stream cascading over a bed composed chiefly of boulders. Only the lower 5 miles are at all passable to salmon, the upper portion having too steep a gradient. Several small, unscreened irrigation diversions occur near the source of the stream at Fish Lake. There were no reports of salmon in Fish Creek, and it is of little possible value to salmon. A few steelhead may utilize a portion of the stream.

5C. Fourmile Creek.— (July 18, 1942; Parkhurst.) Fourmile Creek enters Pine Creek approximately 9½ miles above the mouth. It is a small, short stream, flowing less than 1 c.f.s. and is of no value to salmon.

5D. Deer Creek.— (July 18, 1942; Parkhurst.) Deer Creek enters Pine Creek approximately 13 miles above the mouth. It is a small, short stream, flowing less than 1 c.f.s., and is of no value to salmon.

5E. Applegate Creek.— (July 18, 1942; Parkhurst.) Applegate Creek enters Pine Creek approximately 13 miles above the mouth. The stream is about 9 miles long. It may receive some water from Fish Creek through a short ditch at a point some 6 miles above the mouth. Applegate Creek was discharging less than 2 c.f.s., and was considered to be of little possible value to salmon.

5F. East Pine Creek.— (July 18, 1942; Parkhurst.) East Pine Creek enters Pine Creek approximately 13½ miles above the mouth. The stream is about 18 miles long. It had an average width of 15 feet, and was discharging about 20 c.f.s. East Pine Creek is passable to fish for a distance of about 10 miles, and possesses a considerable amount of good spawning area. It is of little value as a salmon producer at present, but has good potential value. Steelhead are reported to enter during the spring high-water period.

5F-(1). Clear Creek.— (July 18,1942; Parkhurst.) Clear Creek enters East Pine Creek approximately ½ mile above the mouth. The stream is about 17 miles long. It had an average width of 9 feet, and was discharging about 12 c.f.s. Clear Creek is passable to fish for a distance of about 7 miles, and possesses a considerable amount of good spawning area. It is of little value as a salmon producer at present, but has good potential value. Steelhead are reported to enter during the spring high-water period.

5G. East Fork.— (Not surveyed.) The East Fork enters Pine Creek about one mile above the mining camp of Cornucopia, or approximately 30 miles above the mouth. The stream is only about 4 miles long. It was discharging about 30 c.f.s. The gradient of the East Fork is even steeper than that of upper main Pine Creek, the stream descending rapidly in a series of cascades and small falls over a bed composed chiefly of bedrock and boulders. The East Fork was considered to be of no value as spawning area for salmon.

5H. West Fork.— (Not surveyed.) The West Fork and the Middle Fork flow together to form Pine Creek at a point approximately 32 miles above the mouth of the main stream. The West Fork is about 2 miles long, and has its source in two small connected high mountain lakes, which together are about 3/4 mile long. The discharge at the mouth was estimated to be 20 to 30 c.f.s. Like the other tributaries in the headwaters of Pine Creek, the West Fork is a typical turbulent mountain stream, with a steep gradient, and a bed composed chiefly of bedrock and boulders. It was considered to be of no value as spawning area for salmon.

5-I. Middle Fork.— (Not surveyed.) The Middle Fork contributes to the formation of Pine Creek at a point approximately 32 miles above the mouth. The stream is about 2 miles long. The discharge at the mouth was estimated to be 15-20 c.f.s. The gradient is steep, and the stream bed is composed chiefly of bedrock and boulders. Like other mountain streams of this nature, it was considered to be of little or no value as spawning area for salmon, but may be utilized to a limited extent by steelhead trout.

6. Powder River.— (July 2-16, 1942; Parkhurst.) The Powder River joins the Snake River at Robinette, Oregon, approximately 294 miles above the Columbia River confluence. The drainage basin of Powder River and its tributaries comprises more than 1600 square miles of eastern Oregon, and includes portions of both the Blue

Mountains and Minam Divisions of the Whitman National Forest. The main stream is about 114 miles long.

The Powder River originally was an excellent salmon stream, and many old settlers tell of the large runs that appeared in the early days. In the central portion of its course the stream extends through the fertile Baker Valley. This region, along the Old Oregon Trail, was settled at an early date. The growth and extension of agriculture by means of irrigation, together with the more recent extensive mining developments in the upper section of the stream have resulted in the extermination of the salmon runs in the greater part of the Powder River system. There were no fish protective devices on any of the irrigation dams and diversions that were examined. The main stream and particularly its tributaries have some potential value for salmon. However, the runs might be reestablished only at enormous expense for both stream improvements and artificial propagation.

Powder River extends through a narrow, rocky canyon for a distance of about 6 miles above the mouth. The stream had an average width of about 60 feet in this section and was discharging about 250 c.f.s. The major portion of the flow was due to the discharge from Eagle Creek, a major tributary. The water temperature near the mouth was 79.0 F. The prevailing high water temperatures during the summer months probably render the numerous otherwise excellent resting pools in the canyon of little value to salmon. The stream gradient is moderate, with numerous shallow riffles, which all are heavily silted. There is also a large amount of broken bedrock in the stream bed. Less than 10 percent of the bottom was classified as suitable spawning area.

The river gradually emerges from the lower canyon into the flat Eagle Valley, which extends 11 miles upstream. The flow above the confluence of Eagle Creek was about 50 c.f.s., and the water temperature was 78.0 F. The gradient is very slight in this section, and riffle areas are few in number and poor in quality. Pools also are poor and without cover. The stream bed is composed chiefly of mud and silt, and is of no value as spawning area for salmon.

Above Eagle Valley the stream extends for about 12 miles through another narrow, rocky canyon. The gradient is more moderate through this section, and the bottom is not so heavily silted. There are numerous shallow riffles, and about 20 percent of the stream bed might be classified as suitable spawning area, except for several adverse factors which make the section appear unsuitable for salmon. Among these are the high water temperatures, and the low volume of flow that occurs in late summer over the relatively wide stream channel. Both of these adverse factors are due to the extensive irrigation diversions.

Above this canyon the river opens into another flat valley, which extends 12 miles upstream. The flow was about 50 c.f.s. in the lower part of this section, and the water temperature was 78.0 F. The gradient is very slight. The stream bed is composed chiefly of mud and silt, and is of no value as spawning area for salmon. An irrigation diversion dam about 2 feet high and 66 feet long is located about 1.3 miles above Keating, or approximately 37½ miles above the mouth. This dam is not a serious obstacle to fish. The ditch withdraws about 4 c.f.s.

Above the Lower Powder Valley the river extends for 18 miles through the narrow, steep, Thief Valley Canyon. This is an arid, uninhabited region. The stream gradient is moderate, with numerous good riffle areas. On the basis of bottom composition, about 30 percent of the stream bed might be classified as suitable spawning area. Adverse factors include the high water temperatures during the summer months and the large amount of silt. Pools are adequate in number, but practically without any marginal vegetation.

There are several irrigation dams and diversions in the lower part of Thief Valley Canyon. These diversions receive the greatest part of the discharge from the Thief Valley Reservoir Dam.

An irrigation diversion dam is located about ¼ mile above the lower end of the Thief Valley Canyon, or approximately 41 miles above the mouth of the river. This dam is of concrete construction, 6 feet high, and 60 feet long. It is a barrier to fish during low water. Two irrigation diversions, the Duncan Ditch and the Oliver Ditch, originate from either side of the dam, and each withdraws 30 c.f.s.

The Basche Irrigation Diversion Dam is located approximately 42½ miles above the mouth. This dam is of concrete construction, 3 feet high, and 40 feet long. It is a barrier to fish during low water. The ditch withdraws 40 c.f.s.

The Miles Irrigation Diversion Dam is located approximately 44 miles above the mouth. This dam is of concrete construction, 3 feet high, and 40 feet long. It is a barrier to fish during low water. The ditch withdraws 15 c.f.s.

The Thief Valley Reservoir Dam is located approximately 52 miles above the mouth. The U.S. Bureau of Reclamation began construction of this dam in 1931 and completed it in 1932. It is an Ambursen type dam, built entirely of reinforced concrete, and rises to a height of 70 feet above the foundation. The crest length is 390 feet. The spillway is of the concrete overflow type, and is about 268 feet long. The discharge at the time of inspection (July 6, 1942) was 160 c.f.s., which was flowing over the top of the spillway. It was reported by the dam tenders that the reservoir level would soon be below the top of the spillway, and the discharge

would then come through two ports in the base, where it is controlled by two slide-type sluice gates. The average momentary discharge is 75 c.f.s. This dam is a total barrier to fish. Its purpose is to maintain a water storage reservoir in order to provide supplemental irrigation for approximately 6,000 acres in the Lower Powder Valley. The reservoir has a capacity of 17,400 acre-feet. It covers a surface area of 750 acres, and extends for about 3 miles above the dam. It was reported by the dam tenders and other reliable persons that "Silverside" salmon and steelhead trout ascended the stream and congregated at the base of the spillway in each of several successive years after the completion of the dam, and that a large number of these fish were captured here by people who became aware of this condition. The dam tenders reported that no salmon or steelhead had been seen at the base of the dam for several years, the runs to the headwaters evidently having been exterminated.

The Powder River extends for a distance of approximately 28 miles through the broad, flat Baker Valley above the Thief Valley Canyon. The discharge was 107 c.f.s. above the North Powder River confluence on July 5, 1942, but the flow becomes greatly diminished during the late summer and fall irrigation season. The water temperature was over 70 F. throughout this section. The gradient is very slight, and the stream bed is composed almost entirely of mud and silt, with no suitable salmon spawning area. One arm of the stream meanders down the east side of the valley for a distance of 10 miles in a section known as Baldock Slough. A number of small irrigation ditches lead from this slough, serving the east side of Baker Valley and the lower Sunnyslope District. There are a number of small, open irrigation ditches in the Baker Valley section, in addition to several larger, more important installations. Most of the ditches were dry or flowing less than 1 c.f.s. at the time of observation, being used mainly for stock water at that season.

The Estes Irrigation Diversion Dam is located 4 miles below the town of Baker, or approximately 81 miles above the mouth of the river. This dam is 4 feet high and 36 feet long. It had no spill over the crest, the water seeping through and under it, and must be considered a barrier to fish. The ditch is $5\frac{1}{2}$ feet wide at the headgate and was withdrawing less than $\frac{1}{2}$ c.f.s. It was reported that the ditch would be cleaned out in the fall and would have a much larger flow during the irrigation season.

There is another similar low irrigation diversion dam 300 yards above the Estes Dam. The height of this dam varies with the use of stop-logs and flash-boards. It may be a barrier to fish at certain seasons. The foundation is permanently constructed, with a concrete apron extending 15 feet downstream. The ditches at each end of the dam are of small size and without headgates. They were completely dry, and have a capacity of only a few second-feet during the season of maximum use.

The Old Pioneer Irrigation Diversion Dam is located within the city limits of Baker, about ½ mile south of the city center. This dam is 2 feet high and 45 feet long. There was a good flow over the entire crest, making the structure passable to fish. The foundation and abutments are of concrete construction, and it is a simple matter to raise the effective height of the dam by the use of stop-logs. It may be a barrier to fish during the irrigation season, when the volume of the diversion is several times greater. The irrigation canal is 18 feet wide, and is fitted with headgates which were limiting the diversion to about 10 c.f.s.

Above Baker Valley the Powder River extends for a distance of one mile and 2½ miles through two narrow, rocky canyons separated by a small valley 4 miles long. The discharge was about 120 c.f.s. in the lower part of this section, and the water temperature was above 70 F. The gradient is generally moderate, although somewhat less in the valley portion. There are numerous good shallow riffles and adequate resting pools. The stream bed is so heavily silted as a result of mining activity in the headwaters that the underlying rubble composition cannot easily be determined. This condition is so pronounced that it caused the value of this section for salmon spawning to be heavily discounted. It was estimated that less than 10 percent of the stream bed should be classified as suitable spawning area.

An irrigation diversion dam is located near the lower end of the canyon where the Powder River emerges into Baker Valley, about 2 miles above Baker, or approximately 87 miles above the mouth of the stream. This dam is 4 feet high and 36 feet long. It is probably a barrier to fish during low water. The type of construction is typical of that employed on the Powder River; the foundation and abutments are of concrete, and the height of the dam can easily be changed by the adjustment of stop-logs. The ditch is 4 feet wide at the headgate, and was withdrawing about 6 c.f.s.

The Stewart-Shaw Irrigation Diversion Dam is located near the lower end of a canyon about 7 miles south of Baker, or approximately 92 miles above the mouth of the river. This dam is 2 feet high, 36 feet long, and is impassable to fish during low water. Its height can be easily changed. The ditch is about 4 feet wide at the headgate, and was withdrawing 125 miner's inches, or slightly more than 3 c.f.s. It was reported that the average diversion during the irrigation season is 500 miner's inches, or 12½ c.f.s.

The Smith Brothers Irrigation Diversion Dam is located 100 yards above the Stewart-Shaw Dam. This dam is 3 feet high, 39 feet long, and is probably impassable to fish during low water. It is similar in construction to the dams previously described. The diversion canal is 8 feet wide at the headgate, and was withdrawing about 12½ c.f.s. The maximum diversion is 37½ c.f.s.

Proceeding upstream, the Powder River extends for a distance of about 8 miles to the lower end of Sumpter Valley. The discharge in this section was about 140 c.f.s., and the water temperature was above 70 F. In the lower 4 miles the stream flows through a narrow valley. The gradient here is moderate, and there are numerous good shallow riffles and adequate resting pools. The value of this portion of the stream as salmon spawning area was discounted because of the extensive deposition of mining silt. It was estimated that less than 10 percent of the stream bed should be classified as suitable spawning area. In the upper portion of this section the stream gradually becomes confined in a narrow, rocky canyon. The gradient becomes fairly steep, and the bottom is composed chiefly of large rubble and bedrock. There is less silting of the stream bed, but very little spawning area.

The Sumpter Canyon opens upstream into the wide, gently sloping Sumpter Valley, through which the stream extends for a distance of about 12 miles. The stream had an average width of 30 feet and was flowing about 135 c.f.s. in this section. The water temperature ranged from 65 F. to 68 F. The gradient here is generally moderate, and there are numerous good riffle areas and adequate resting pools. The stream bed is covered throughout with such a heavy layer of silt that it is impossible to determine the underlying rubble composition, and this portion of the stream was adjudged to be of no value as salmon spawning area under these conditions. The water was also extremely turbid, and silt was being deposited continually. In the upper half of this section, from McEwen upstream to Sumpter, a distance of somewhat more than 6 miles, the stream bed was either torn up or in the process of being torn up by gold dredges, which caused heavy silting downstream. The stream bed was transformed into conical mounds of gravel tailings, and the banks were often dug away and denuded of marginal vegetation.

The Powder River is formed at Sumpter by the confluence of Cracker Creek and McCully Fork.

6A. Daly Creek.— (July 16, 1942; Parkhurst.) Daly Creek enters the Powder River approximately 7 miles above the mouth. It is a small stream, about 10 miles long, and was discharging about 5 c.f.s. The water temperature was 75 F. at the mouth. The gradient is slight, and the lower portion of the stream bed was heavily silted. Daly Creek offers only slight attraction to salmon, and was considered to be of little value.

6B. Eagle Creek.-- (July 16, 1942; Parkhurst.) Eagle Creek enters the Powder River approximately 9 miles above the mouth, near the town of Richland. The stream is about 36 miles long, and drains the south slope of the uninhabited, heavily forested Eagle Cap Primitive Area of the Wallowa Mountains. A comparatively small portion of its waters are diverted for agricultural use, and most of the watershed remains practically untouched by man, thus assuring a fairly constant flow of clear, cold water.

For a distance of about 11 miles above the mouth to the entrance of the Whitman National Forest, the stream extends through a gently sloping valley which gradually narrows upstream. The stream was 60 to 70 feet wide in this section, and was discharging about 200 c.f.s. The water temperature ranged from 59 F. near the mouth to 57 F. upstream. The gradient is moderate and the stream bottom is composed chiefly of medium and small rubble. Good shallow riffles are almost continuous for the first 6 miles, and adequate resting pools first appear in the succeeding 5 miles. It was estimated that 75 to 90 percent of the stream bed in this section constituted suitable salmon spawning area.

A log wing dam located about 7 miles above the mouth was diverting about 5 c.f.s. into an irrigation ditch. This dam does not extend entirely across the stream, and is not a barrier to fish.

A small irrigation diversion occurs about 9 miles above the mouth. There is no dam in connection with this ditch, and it was withdrawing only about 2 c.f.s.

Another irrigation diversion occurs about 11 miles above the mouth, just 100 yards below the entrance to the Whitman National Forest. There is no dam in connection with this ditch, and it was withdrawing about 10 c.f.s., which seemed to be a capacity flow.

Above this point the stream extends through the Whitman National Forest, and there are no habitations except the U. S. Forest Service Guard Stations. From a point near the National Forest entrance to the headwaters the stream runs through a narrow, rocky canyon, which becomes increasingly steep as it narrows upstream. The stream was about 50 feet wide at the lower end of this section, and was discharging about 170 c.f.s. The water temperature ranged from 57 F. to 54 F. The gradient is moderate to fairly steep, increasing upstream. There are numerous good riffle areas, which become smaller as the stream becomes more narrow, and the gradient, pools, and large rubble increase.

Main Eagle Creek has its source in Eagle Lake, and it is also fed by short, steep tributaries leading from several other small, high mountain lakes.

Eagle Creek is one of the few streams in eastern Oregon that is reported to maintain at present a fairly good run of chinook salmon. The stream also has a good run of steelhead trout. It has the greatest present and potential value to salmon of any of the smaller streams in this area.

6B-(1) Skull Creek.-- (July 16, 1942; Parkhurst.) Skull Creek enters Eagle Creek approximately 11 miles above the mouth. It is about 4 miles long. Skull Creek is a small stream, flowing less than 1 c.f.s. It has a steep gradient, and is of no value to salmon.

6B-(2). Little Eagle Creek.— (July 16, 1942; Parkhurst.) Little Eagle Creek enters Eagle Creek approximately 12½ miles above the mouth. It is about 9 miles long. About 2 miles above the mouth the gradient becomes too steep for the stream to be of value to salmon. The stream had an average width of 18 feet in the lower section, and was discharging about 15 c.f.s. The water temperature near the mouth was 57 F. The gradient in the first 2 miles above the mouth is moderate to fairly steep, with numerous excellent shallow riffles and a few small resting pools. It was estimated that 75 percent of the bottom in this portion of the stream constituted suitable salmon spawning area. Although no spawners were seen at the time of inspection, Little Eagle Creek is of value to a small number of salmon.

6B-(3). Paddy Creek.— (July 16, 1942; Parkhurst.) Paddy Creek enters Eagle Creek approximately 18½ miles above the mouth. It is about 4 miles long. Paddy Creek is a small stream, flowing less than 2 c.f.s. It has a steep gradient, and is of no value to salmon.

6B-(4). East Fork.— (Not surveyed.) The East Fork enters Eagle Creek approximately 21½ miles above the mouth. It is about 14 miles long, of which the lower 8 miles are passable, up to East Eagle Falls. The stream was discharging about 60 c.f.s. The lower portion of the East Fork is known to be of some value to salmon.

6B-(5). West Fork.— (Not surveyed.) The West Fork enters Eagle Creek approximately 26½ miles above the mouth. It is about 9 miles long, and flows from two small, high mountain lakes. The Sparta Irrigation Ditch withdraws a good portion of the West Fork at a point about 1½ miles above the mouth. The lower portion of the stream is of some value to salmon, although the Sparta Ditch presents a hazard to downstream migrants.

6C. Kirby Creek.— (July 16, 1942; Parkhurst.) Kirby Creek enters the Powder River approximately 10 miles above the mouth, or less than a mile above main Eagle Creek. Kirby Creek is actually a small branch of Eagle Creek, leaving the main Eagle Creek channel about 2 miles above the mouth. The stream had an average width of 12 feet and was discharging about 5 c.f.s. The water temperature was 65 F. near the mouth.. The gradient is slight to moderate, with numerous shallow riffles and few large resting pools. There is a large amount of sand in the stream bed. It was estimated that 20 percent of the bottom constituted suitable salmon spawning area. The stream is of some value to adult salmon, and offers considerable protection to fingerlings.

6D. Big Creek.— (Not surveyed.) Big Creek enters the Powder River approximately 44 miles above the mouth. It is about 15 miles long. Big Creek had an average width of about 30 feet, and was estimated to be discharging between 25 and 30 c.f.s. Although its present value was not determined, it is reported to have formerly supported a good run of salmon.

6E. Wolf Creek.-- (July 5, 1942; Parkhurst.) Wolf Creek enters the Powder River approximately 58 miles above the mouth. It is about 16 miles long. The stream had an average width of 8 feet, and was discharging about 4 c.f.s. The water temperature was 72 F. near the mouth. The gradient is moderate, with numerous shallow riffles and small pools. It was estimated that 30 percent of the bottom constituted suitable salmon spawning area. The stream is wholly inaccessible to anadromous fish because of the Thief Valley Dam. It is of slight potential value to salmon.

6F. North Powder River.-- (July 7, 1942; Parkhurst.) The North Powder River enters the main Powder River approximately 61 miles above the mouth. It is about 26 miles long. The North Powder extends through a gently sloping, cultivated valley for a distance of about 11 miles from the mouth to Anthony Fork. The stream had an average width of about 25 feet in this section, and was discharging 49 c.f.s. The water temperature ranged from 70 F. at the mouth to 54 F. at Anthony Fork. The gradient is moderate, with numerous good shallow riffle areas and adequate resting pools. The stream bed is composed chiefly of medium and small rubble, and it was estimated that 30 percent of the bottom in the lower 6 miles and 50 percent of the bottom in the next 5 miles constituted suitable salmon spawning area.

An irrigation diversion dam is located about $1\frac{1}{2}$ miles above the mouth, at the town of North Powder. This dam is 1 foot high, about 50 feet long, and is not a barrier to fish except during low water. The ditch is 6 feet wide and was withdrawing $2\frac{1}{2}$ c. f. s.

Another irrigation diversion dam is located a short distance above the town of North Powder. This dam is about 2 feet high, 30 feet long, and is not a barrier to fish except during low water. The ditch was withdrawing about 4 c.f.s.

An irrigation diversion dam is located about 7 miles above the mouth. This dam is 2 feet high, 30 feet long, and is not a barrier to fish except during low water. The ditch is 6 feet wide, and was withdrawing about 2 c.f.s.

Above Anthony Fork the North Powder extends through a narrow canyon, which becomes increasingly steep as it narrows upstream. For the first 3 miles of this section, up to the mouth of Antone Creek, the stream had an average width of 18 feet, and was discharging $27\frac{1}{2}$ c.f.s. The water temperature was 52 F. The gradient is fairly steep, with some small, shallow riffle areas, and many small cascades. It was estimated that about 30 percent of the stream bed between Anthony Fork and Antone Creek constituted suitable salmon spawning area.

Above Antone Creek the stream extends for a distance of some 12 miles to its source in two small, high mountain lakes. This upper section is of no possible value as salmon spawning area because of the increasingly steep gradient, preponderance of large rubble, and

greatly reduced flow. The discharge just above the mouth of Antone Creek was only 7½ c.f.s.

The Big Bulger Irrigation Diversion Dam is located 2 miles above Antone Creek, or 16 miles above the mouth. This dam is 3 feet high and 18 feet long. It is a barrier to fish during low water. The ditch is 10 feet wide and withdraws 30 c.f.s.

The Hartung-Nicholson Irrigation Ditch located about 16½ miles above the mouth. There is no dam in connection with this diversion. The ditch is 4 feet wide and withdraws 75 miner's inches, or less than 2 c.f.s.

The Big Mansfield Irrigation Ditch is located about 17 miles above the mouth. There is no dam in connection with this diversion. The ditch is 7 feet wide and withdraws 20 c.f.s.

The Warfield-Burnside Irrigation Ditch is located about 17 miles above the mouth. There is no dam in connection with this diversion. The ditch is 6 feet wide and withdraws 150 Miner's inches, or 3.75 c.f.s.

The Little Mansfield Irrigation Ditch is located about 17½ miles above the mouth. There is no dam in connection with this diversion. The ditch is 7 feet wide and withdraws 7½ c.f.s.

The Savage Irrigation Diversion Dam is located about 18 miles above the mouth. This dam is 2 feet high and is a barrier to fish during low water. The ditch is 7 feet wide and withdraws 10 c.f.s.

The North Powder River was originally an excellent salmon stream. The early agricultural development of the North Powder Valley has resulted in the extensive diversion of water for irrigation purposes. It was reported that during the irrigation season, in late summer and fall, the discharge at the mouth of the North Powder is often less than 5 c.f.s. Under these conditions the stream is of no value to salmon. More recently the construction of the impassable Thief Valley Dam on the main Powder River has rendered the North Powder inaccessible at all times to salmon and steelhead.

6F-(1). Anthony Fork.-- (July 7, 1942; Parkhurst.) Anthony Fork enters the North Powder River approximately 11 miles above the mouth. It is about 12 miles long, of which the lower 2 miles were surveyed. Above this point the stream extends through a narrow, rocky canyon, and is of no possible value to migratory fish because of the steep gradient. The stream had an average width of 24 feet in the section surveyed, and was discharging about 30 c.f.s. The water temperature was 55 F. near the mouth. The gradient is moderate

in the lower 2 miles, with numerous good shallow riffles and small pools. This lower section of the stream bed is composed chiefly of medium and small rubble, and it was estimated that 50 percent of the bottom constituted suitable salmon spawning area. The lower section of Anthony Fork was reported to have formerly supported a good run of chinook salmon and steelhead trout. It is now inaccessible and of no present value to these species.

6F-(2). Antone Creek.-- (July 7, 1942; Parkhurst.) Antone Creek enters the North Powder River approximately 14 miles above the mouth. It extends for about 4½ miles to its source in a small, high mountain lake. The stream was 15 feet wide at the mouth, and was discharging about 20 c.f.s. The volume decreases rapidly upstream, the discharge at the outlet of Anthony Lake being less than 5 c.f.s. The water temperature at the mouth was 49 F. The gradient is steep, and increases upstream. Antone Creek is mainly a succession of cascades and small falls, with the stream bed composed chiefly of bedrock and large rubble. Less than 10 percent of the bottom constitutes suitable salmon spawning area. Antone Creek is of no value to salmon at present and of little potential value. A few steelhead may have formerly entered the stream.

6F-(3). Dutch Flat Creek.-- (Not surveyed.) Dutch Flat Creek enters the North Powder River approximately 15 miles above the mouth. It extends for about 8 miles to its source in several small, high mountain lakes. It is a typical turbulent mountain stream of steep gradient, similar to Antone Creek, and is of no value to salmon.

6G. Muddy Creek.-- (July 5, 1942; Parkhurst.) Muddy Creek enters the Powder River 2 miles below the town of Haines, or approximately 71 miles above the mouth. It is a small stream, about 8 miles long, and was discharging less than 3 c.f.s. Several small open ditches take most of the flow for irrigation and stock watering. Muddy Creek was considered of no possible value to salmon.

6H. Rock Creek.-- (July 5, 1942; Parkhurst.) Rock Creek enters the Powder River 1 mile below the town of Haines, or approximately 72 miles above the mouth. It is a small stream, about 13 miles long, and was discharging less than 5 c.f.s. Several small open ditches take most of the flow for irrigation and stock watering. Rock Creek was considered of no possible value to salmon.

6-I. Pine Creek.-- (July 4, 1942; Parkhurst.) Pine Creek enters the Powder River 2 miles above the town of Haines, or approximately 75 miles above the mouth. It is about 10 miles long, and was discharging about 5 c.f.s. Several small open ditches take most of the flow for irrigation and stock watering. Pine Creek was considered of little possible value to salmon.

6J. Sutton Creek.— (July 3, 1942; Parkhurst.) Sutton Creek enters the Powder River a half mile above the town of Baker, or approximately 85½ miles above the mouth. It is about 13 miles long, and was discharging about 3 c.f.s. Because of its small size Sutton Creek was considered to be of little possible value to salmon.

6K. Beaver Creek.— (July 3, 1942; Parkhurst.) Beaver Creek enters the Powder River 6 miles above the town of Baker, or approximately 91 miles above the mouth. It is a small stream, about 8 miles long, and was discharging less than 1 c.f.s. Beaver Creek was considered to be of no possible value to salmon.

6L. Deer Creek.— (July 2, 1942; Parkhurst.) Deer Creek enters the Powder River about 3 miles below the town of McEwen, or approximately 105 miles above the mouth. It is about 12 miles long. The stream was 15 feet wide in the lower section, and was discharging about 5 c.f.s. The water temperature was 65 F. near the mouth. The gradient is moderate, with numerous shallow riffle areas. The stream bed is composed chiefly of medium and small rubble, and it is estimated that 75 percent of the bottom constitutes suitable salmon spawning area. There is an irrigation diversion dam located about 1 mile above the mouth. This dam is less than 2 feet high, and is not a barrier to fish. The ditch was withdrawing about 2 c.f.s. Because of its small size, Deer Creek was considered to be of little potential value to salmon.

6M. Cracker Creek.— (July 2, 1942; Parkhurst.) Cracker Creek enters the Powder River at the town of Sumpter, approximately 114 miles above the mouth. Cracker Creek and its principal tributaries extend through narrow mountain valleys, which merge into steep canyons in the upper sections of the streams. The watershed is mountainous, and possesses a moderate cover of small conifers. The streams are cold, generally clear, and of fairly constant, large volume. Cracker Creek is about 10 miles long, of which the lower 6½ miles, up to the mouth of Little Cracker Creek, appeared suitable for salmon spawning. There are no artificial obstructions or diversions.

In the first 5 miles above the mouth, up to Silver Creek, the stream had an average width of 30 feet. The discharge at the mouth was more than 90 c.f.s., and the water temperature was 54 F. The gradient is fairly steep, with numerous fast riffle areas and adequate resting pools. The stream bed is composed chiefly of medium and small rubble, and it is estimated that 50 percent of the bottom constitutes suitable salmon spawning area.

Above Silver Creek the stream is much smaller. In the section between Silver Creek and Little Cracker Creek the stream had an average width of 15 feet, and was flowing at a rate of 30 c.f.s. The water temperature was 52 F. The gradient remains fairly steep, with numerous fast riffle areas. Suitable salmon spawning area continues to constitute about 50 percent of the bottom.

Above Little Cracker Creek the gradient increases rapidly, and the stream acquires a torrential velocity which renders it unsuitable for salmon spawning. The stream has its source near the summit of the Blue Mountains at an elevation of more than 7,000 feet.

Although Cracker Creek is at present wholly inaccessible to salmon and steelhead because of obstructions in the Powder River, it has good potential value, particularly for steelhead trout.

Several small, very steep, turbulent streams, which are of no possible value to salmon, enter the lower portion of Cracker Creek.

6M-(1). Pole Creek.-- Enters about 3 miles above the mouth and was discharging less than 5 c.f.s.

6M-(2). Slim Creek.-- Enters 3 miles above the mouth and was discharging less than 2 c.f.s.

6M-(3). Wind Creek.-- Enters 3½ miles above the mouth and was discharging less than 5 c.f.s.

6M-(4). Silver Creek.-- (July 2, 1942; Parkhurst.) Silver Creek enters Cracker Creek approximately 5 miles above the mouth. It is about 6 miles long, of which the lower 2 miles appeared somewhat suitable for salmon spawning.

In this lower section the stream had an average width of 24 feet, and was discharging about 50 c.f.s. The water temperature was 50 F. The gradient is too steep for the best type of salmon spawning area. Medium and small rubble in numerous small pools and riffles make up a large part of the stream bed. It is estimated that about 30 percent of the bottom in this section constitutes suitable spawning area. In the upper section the gradient becomes too steep for the stream to be of any possible value to salmon. Although inaccessible at present, Silver Creek has some potential value, particularly for steelhead trout.

6M-(5). Little Cracker Creek.-- (July 2, 1942; Parkhurst.) Little Cracker Creek enters Cracker Creek at the village of Bourne, approximately 6½ miles above the mouth. It is a small stream, about 2 miles long, and discharging about 5 c.f.s. The first mile above the mouth contains some suitable salmon spawning area. Because of its small size, Little Cracker Creek was considered of slight potential value to salmon.

6N. McCully Fork.-- (July 2, 1942; Parkhurst.) McCully Fork enters the Powder River at the town of Sumpter, approximately 114 miles above the mouth. It is about 9 miles long, of which the lower 5 miles appeared suitable for salmon spawning. For the first 3 miles above the mouth the stream flows across the upper end of the gently sloping, open Sumpter Valley. It then extends for some 2 miles through low, rolling hills moderately covered with young pines. In this first 5 miles the stream had an average width of 20 feet, and was discharg-

ing about 15 c.f.s. The water temperature was 54 F. at the confluence with the Powder River. The gradient is moderate, with numerous excellent shallow riffles. There are few resting pools in this section. The stream bed is composed chiefly of medium and small rubble, and it is estimated that 75 percent of the bottom constitutes suitable salmon spawning area. In the uppermost section the stream has a fairly steep gradient, and extends for about 4 miles through a narrow, forested valley. McCully Fork has some good potential value for salmon, although it is at present wholly inaccessible because of obstructions in the Powder River.

7. Burnt River.-- (September 27-30, 1941, and June 28 - July 1, 1942; Parkhurst and Zimmer.) Burnt River joins the Snake River near Huntington, Oregon, 326 miles above the Columbia River confluence. Its drainage basin covers an area of approximately 1200 square miles. The main stream extends for a distance of 78 miles to the Unity Reservoir. Above the impassible Unity Dam several tributaries extend for a total distance of about 65 miles to the headwaters.

The climate of the Burnt River region is semi-arid in character, making irrigation essential to crop production. The predominant type of farming is range livestock. Practically all cropland acreage is in either pasture, hay, or grain.

Reports from old settlers indicate that Burnt River once supported a good run of chinook salmon. This run has been greatly depleted for many years. One of the causes of this depletion has been that before the construction of the Unity Storage Reservoir the stream volume became very low during the irrigation season because of the extensive use of water for agricultural purposes. Because of the present ample reservoir storage facilities, such extreme low water conditions no longer occur. However, the Unity Reservoir Dam and another upper storage dam now render some spawning area inaccessible to migratory fish. There are 39 direct irrigation diversions between the mouth of Burnt River and Unity Dam, and 46 irrigation diversions on the tributaries that flow into the reservoir above the dam. None of these are equipped with any fish-protective devices. Almost all of the diversions occur through open ditches, without headgates, the flow being regulated by alteration of the dams. Most of the ditches have good returns to the river, and the water is used repeatedly. Almost all of the diversion dams are of a temporary nature, and are constructed of logs, loose rock, planks, and timbers. Few of them are more than 3½ feet high, and since the construction of Unity Dam, none of those below that point are barriers to salmon, all having a good spill over their crests when in use. This is because the members of the irrigation district sponsor a policy of allowing a discharge from the reservoir considerably in excess of their water needs, in order that all the water users may be easily supplied.

Burnt River is of little value as a salmon producer at present. No salmon were seen during the survey, although there are reports that a few salmon fingerlings have been captured in recent years, and a few spawners may still enter the stream. Burnt River has some potential value for salmon, although the large number of unscreened irrigation diversions are a definite hazard to downstream migrants. The main stream is usually turbid, due to returns from the irrigation ditches, and also due to gold mining activity. The amount of available spawning area would be slightly increased by the construction of fishways over Unity Dam. The South Fork is the most suitable tributary for salmon above Unity Dam, but in order for it to be made fully available the Whited Reservoir Dam 6 miles above the Unity Reservoir would likewise have to be provided with fishways. It is extremely doubtful if the amount of potential spawning area on the South Fork would justify the expense for the construction of fishways over these two dams. This is especially true since the run is so depleted that a restocking program would have to be devised in any attempt to reestablish salmon in Burnt River.

Topographically the Burnt River drainage basin may be divided into six sections: (1) Huntington Valley; (2) Durkee Valley; (3) Burnt River Canyon; (4) Bridgeport Valley; (5) Hereford Valley; and (6) Unity Valley and headwater areas.

Section (1) - Huntington Valley:

Burnt River extends through the Huntington Valley for a distance of 23 miles above the mouth. The valley varies generally in width from 100 yards to 400 yards. The stream had an average width of 18 feet in this section, and was discharging 14½ c.f.s. at its confluence with the Snake River. The water temperature at the mouth was 76.5 F. The gradient is moderate, being 25 feet per mile, with numerous good shallow riffles. There are few good resting pools. The stream bed is composed chiefly of medium and small rubble, and it is estimated that 30 percent of the bottom constitutes suitable salmon spawning area. There are 9 irrigation ditches, with a total water diversion of slightly more than 15 c.f.s.

Section (2) - Durkee Valley:

Above Huntington Valley the stream extends for a distance of 6½ miles through the Durkee Valley. The valley has an average width of about three-fourths of a mile. The stream had an average width of 24 feet in this section, and was discharging slightly more than 22 c.f.s. The water temperature was 75 F. at the lower end of the valley. The gradient is 15 feet per mile. There are few shallow riffles, but numerous pools. The stream bed is composed chiefly of mud and sand, and there is practically no suitable salmon spawning area. There are 7 irrigation ditches, with a total water diversion of almost 32 c.f.s.

Section (3) - Burnt River Canyon:

This section of the river extends for a distance of about 14 miles through a narrow, steep, rocky gorge. Several large-scale

gold dredging projects are located in Burnt River Canyon, but it was reported that these operations were discontinued during World War II. These dredges operated directly in the stream channel, forming conical mounds of gravel tailings five to eight feet in height as they slowly progressed upstream. At the time of observation they had not blocked the channel to the migration of fish at any point. The dredges were aided by power shovels that removed large quantities of gravel from the alluvial fan deposits at the mouths of several small, intermittent tributaries. The stream had an average width of 30 feet in this section, and was discharging slightly more than 45 c.f.s. The water temperature was 70 F. at the lower end of the canyon, and the prevailing high water temperature during the summer months is an adverse factor in any evaluation of this section for salmon. The gradient is moderate to fairly steep, having an average rise of 48 feet per mile. There are numerous good shallow riffles, but few large resting pools. The stream bed is composed chiefly of medium and small rubble, and it is estimated that 60 percent of the bottom constitutes suitable salmon spawning area. Aside from the high water temperatures that occur in this part of the main Burnt River, it appears to be the best part of the stream for salmon spawning. There are three small irrigation ditches, none of which were in operation at the time of observation.

Section (4) - Bridgeport Valley:

Burnt River Canyon opens above into the Bridgeport Valley, which extends about 15 miles upstream. For the most part the Bridgeport Valley is about a mile wide, but in the upper three miles it narrows rapidly into a small canyon. The stream had an average width of 27 feet, and was discharging 41 c.f.s. The water temperature was 69 F. at the lower end of the valley. The gradient is slight for the most part, having an average rise of 10 feet per mile. There are few shallow riffles, but pools are almost continuous. The stream bed is composed chiefly of medium and small rubble, with a heavy layer of mud and silt. It is estimated that 10 percent of the bottom constitutes suitable salmon spawning area. The upper three miles of this section have a higher gradient, less silt in the stream bed, and better spawning area. There are seven irrigation ditches, with a total water diversion of about 62 c.f.s.

Section (5) - Hereford Valley:

Above Bridgeport Valley, Burnt River extends for a distance of 20 miles upstream through Hereford Valley to Unity Dam. This valley has an average width of about one mile. Terraces and bench lands encroach until the stream is finally confined to a narrow, rocky gorge for the upper 1½ miles. The average width of the stream was 30 feet.

The discharge at the lower end of the valley was about 53 c.f.s., and the water temperature was 64 F. The gradient is slight for the most part, having an average rise of 12 feet per mile. There are few shallow riffles, but pools are almost continuous. The stream bed is composed chiefly of medium and small rubble, with a heavy layer of mud and silt. There is no suitable salmon spawning area except for a small amount in the upper 1½ miles, where the gradient becomes moderate and there is less silt. There are 11 irrigation ditches, with a total water diversion of slightly more than 56 c.f.s.

Section (6) - Unity Valley and headwaters:

Unity Dam is located at the narrow, upper end of the Hereford Valley. The dam was built by the U. S. Bureau of Reclamation in order to provide a water storage reservoir to supplement the irrigation of lands along Burnt River. Its construction was begun in 1936 and was completed in 1939, when the operation and maintenance of the project was turned over to the Burnt River Irrigation District. The dam has a height of 76 feet above the stream channel, and a crest length of 694 feet. It is of the earth embankment type, with the spillway and outlet works constructed of concrete. The spillway is an open rectangular chute controlled by two large radial gates. The outlet works consist of a tunnel 7½ feet in diameter and 620 feet long, gate controlled, and protected at the submerged inlet by an iron grizzly. This tunnel is impassable to any fish seeking to migrate farther upstream. At the time of observation in the latter part of June, 1942, the discharge at the dam was from 89 c.f.s. to 87 c.f.s. No fishways are provided, and the dam is a total barrier to the upstream passage of fish. The reservoir has a capacity of 25,400 acre feet, and a surface area of 925 acres. It is subject to considerable variation in water level. At the time of the survey in September, 1941, the reservoir was 22 feet below the high water level. At high water stages it extends for a mile or more above the original mouths of the principal tributaries.

All the tributaries to Burnt River entering below Unity Dam are small, intermittent, and of no possible value to salmon. These include 7A Durbin Creek, 7B Marble Creek, 7C Dixie Creek, 7D Damen Jet Creek, 7E Chicken Creek, 7E-(1) Sisley Creek, 7F Shirttail Creek, 7G Swayze Creek, 7G-(1) Manning Creek, 7H Durkee Creek, 7I Alder Creek, 7I-(1) Lawrence Creek, 7J Powell Creek, 7K Deer Creek, 7L Dark Canyon Creek, 7M Clarke Creek, 7N Auburn Creek, 7-O Mill Creek, 7P Pine Creek, 7Q Independence Creek, 7R Big Creek, 7R-(1) Cow Creek, and 7S Camp Creek.

7T. Job Creek.-- (September 27, 1941; Parkhurst and Zimmer.) Job Creek enters Unity Reservoir approximately a mile above the dam. It is a small stream, about 7 miles long. It has 6 small irrigation ditches diverting a total of about 10½ c.f.s., which is practically the entire flow. Job Creek is of no possible value to salmon.

7U. South Fork, Burnt River.-- (September 27-30, 1941; Parkhurst and Zimmer.) The South Fork enters Unity Reservoir approximately 2 miles above the dam. It is about 16 miles long, and was surveyed for a distance of 13 miles to the mouth of Spring Creek. Above this point the stream was flowing less than 2 c.f.s., and was considered too small to be of any possible value to salmon. The stream was 15 feet wide near the mouth, and was discharging about 15 c.f.s. into the Unity Reservoir. The mouth of the stream at the time of the survey was 1000 yards below the high water level of Unity Reservoir. The volume of flow in the stream channel varies widely at different points in the first 6½ miles above the mouth, due to the intake and return flows of numerous diversions. The water temperature ranged from 49 F. at the mouth to 46 F. at the upper terminus of the survey. From the mouth to Whited Reservoir, a distance of about 6 miles, the gradient is slight to moderate, with numerous small riffles and well protected resting pools. The stream bed is composed chiefly of medium and small rubble, and there is also a large amount of silt. There were 18,000 square yards of suitable spawning area, constituting approximately 27 percent of the total bottom in this section. There are 8 irrigation ditches on the South Fork up to Whited Reservoir, with a total water diversion of 48 c.f.s. With one exception, none of them have dams which might obstruct the passage of fish.

The Whited Reservoir Dam is of the earth embankment type, approximately 40 feet high and 75 feet long. The outlet extends through the base of the dam, and is gate controlled. No fishways are provided, and the dam is a total barrier to the upstream passage of fish. The Whited Reservoir extends about ½ mile upstream, and has a maximum width of somewhat more than ¼ mile.

Above the Whited Reservoir Dam the stream extends for a distance of 7 miles to the terminus of the survey. The gradient is moderate, with numerous good shallow riffles and small pools. The stream bed is composed chiefly of medium and small rubble, and there is much less silt than occurs below. There were 46,000 square yards of suitable spawning area, constituting approximately 52 percent of the total bottom in this section. There are 6 irrigation ditches, with a total water diversion of about 65 c.f.s. There are no dams above Whited Reservoir that are barriers to fish.

7U-(1) Pole Creek.-- (September 30, 1941; Parkhurst and Zimmer.) Pole Creek enters the South Fork of Burnt River approximately 5 miles above the mouth. It is about 6 miles long, and was discharging less than 1 c.f.s. There are 5 small irrigation ditches on the stream. It is of no present or potential value to salmon.

7U-(2). Bullrun Creek.-- (September 30, 1941; Parkhurst and Zimmer.) Bullrun Creek enters the South Fork of Burnt River approximately 8 miles above the mouth. The stream is about 7 miles long.

There are 3 irrigation ditches on Bullrun Creek, diverting a total of more than 13 c.f.s., which is practically the entire flow. It is of no present or potential value to salmon.

7U-(3). Sheep Creek.— (September 30, 1941; Parkhurst and Zimmer.) Sheep Creek enters the South Fork of Burnt River approximately 8½ miles above the mouth. The stream is about 5 miles long, and was discharging less than 1 c.f.s. It is of no present or potential value to salmon.

7U-(4). Amelia Creek.— (September 29, 1941; Zimmer.) Amelia Creek enters the South Fork of Burnt River approximately 10 miles above the mouth. It is a small stream, about 4 miles long, and was discharging about ½ c.f.s. There are 2 small irrigation ditches on Amelia Creek. The stream is of no present or potential value to salmon.

7U-(5). Barney Creek.— (September 29, 1941; Zimmer.) Barney Creek enters the South Fork of Burnt River approximately 11 miles above the mouth. It is a small stream, about 4 miles long, and was discharging less than 1 c.f.s. There is one small irrigation ditch on Barney Creek. The stream is of no present or potential value to salmon.

7U-(6). Elk Creek.— (September 30, 1941; Parkhurst.) Elk Creek enters the South Fork of the Burnt River approximately 12 miles above the mouth. It is about 5 miles long, of which 3/4 mile was surveyed, up to the mouth of Last Chance Creek. Above the terminus of the survey the stream was flowing about 4 c.f.s., and was too small and steep to be of more than slight potential value to salmon. Elk Creek had an average width of 15 feet in the section surveyed, and was discharging about 10 c.f.s. The water temperature was 49 F. at the mouth and 46 F. just above Last Chance Creek. Mammoth Spring enters 300 yards below Last Chance Creek, and adds approximately 1 c.f.s. The spring temperature was 50.5 F. The gradient is moderate and there are numerous small riffles and pools. The stream bed is composed chiefly of small rubble and gravel, and there were 6,300 square yards of suitable spawning area, constituting approximately 86 percent of the total bottom in the section surveyed. The stream is wholly inaccessible to salmon, and is of no present value.

7U-(6)a. Last Chance Creek.— (September 30, 1941; Parkhurst.) Last Chance Creek enters Elk Creek 3/4 mile above the mouth. It is about 5 miles long, and was discharging about 4 c.f.s. The stream becomes too small and steep a short distance above the mouth to be of more than slight potential value to salmon.

7U-(7). Spring Creek.— (September 30, 1941; Zimmer.) Spring Creek enters the South Fork of Burnt River approximately 13 miles above the mouth. It is a small stream, about 3 miles long, and was discharging less than 1 c.f.s. Spring Creek is of no present or potential value to salmon.

7V. Middle Fork, Burnt River.— (September 28, 1941; Parkhurst and Zimmer.) The Middle Fork enters Unity Reservoir approximately 1 mile above the South Fork. It is about 10 miles long, and was discharging less than 2 c.f.s. There are 8 irrigation ditches on the Middle Fork, diverting a total of more than 6 c.f.s. The stream is wholly inaccessible to salmon, and is of no present or potential value.

7W. West Fork, Burnt River.— (September 28, 1941; Parkhurst and Zimmer.) The West Fork enters Unity Reservoir approximately 1 mile above the Middle Fork. It is about 6 miles long, and was discharging less than 2 c.f.s. There are 2 irrigation ditches on the West Fork, diverting a total of more than 4 c.f.s. The stream is wholly inaccessible to salmon, and is of no present or potential value.

7X. North Fork, Burnt River.— (September 28, 1941; Parkhurst and Zimmer.) The North Fork enters Unity Reservoir approximately 1 mile above the West Fork. It is about 25 miles long and was discharging less than 1 c.f.s. The gradient is moderate. The stream bed is composed chiefly of large rubble, with little suitable spawning area and few good pools. There are 4 irrigation ditches on the North Fork, diverting a total of more than 35 c.f.s.

An irrigation diversion dam is located approximately 3 miles above the mouth. This dam is 84 feet long, 3 feet high, and is a barrier to fish during low water. The irrigation ditch is 5 feet wide, and was withdrawing about 1 c.f.s., which was the entire stream flow at this point except for a small amount of seepage.

Another irrigation diversion dam is located approximately 5 miles above the mouth, at the entrance to the Whitman National Forest. This dam is 130 feet long and 3 feet high. It is a barrier to fish during low water. The irrigation ditch is 6 feet wide, and was withdrawing about 6 c.f.s., leaving less than 1 c.f.s. in the stream channel. A gold dredge was in operation 18 miles above the mouth, near Whitney, Oregon, causing the stream below to be very turbid. The North Fork is wholly inaccessible to salmon, and is of no present or potential value.

7X-(1). China Creek.— (September 28, 1941; Parkhurst and Zimmer.) China Creek enters the North Fork of Burnt River approximately 3½ miles above the mouth. It is a small stream, about 6 miles long, and was discharging less than 2 c.f.s. There is one small irrigation ditch on China Creek. The stream is of no present or potential value to salmon.

SUMMARY OF RECOMMENDATIONS

Immaha River

Since the Immaha has not been subjected to demands for water use, it is a stream in which runs of chinook salmon and steelhead trout may be maintained, and every possible attempt should be made to restore the runs to their former abundance.

Pine Creek

The decreased volume of flow during the summer months over the wide stream bed in the Pine Valley region, due to numerous small irrigation diversions, has had the twofold effect of causing high water temperatures and hampering the upstream migration of salmon. Since the agricultural demand for water does not permit the alleviation of this condition, it is not advisable to attempt the restoration of the salmon run into this stream.

Powder River

The barrier imposed by the Thief Valley Dam has rendered the greater portion of the Powder River and most of the spawning area inaccessible to migratory fish. The difficulty of constructing adequate fishways over this storage reservoir dam of fluctuating water level, as well as the necessity for screening numerous irrigation ditches above the dam and maintaining an adequate flow at the time of salmon migration, make any program for the restoration of the salmon run to the upper Powder River doubtful of success and economically unfeasible.

Eagle Creek, a large tributary to the lower Powder River, offers excellent salmon spawning area. Sufficient discharge should be allowed from the Thief Valley Reservoir at the time of salmon migration to insure the passage of salmon up to the mouth of Eagle Creek.

Burnt River

The difficulty of providing adequate fishways over the Unity Reservoir Dam due to the great fluctuation in water level, and the numerous irrigation diversions on Burnt River, together render the stream of little potential value to salmon. Therefore it is not recommended that any attempt be made to restore the run of salmon to this stream.

*

TABLE OF OBSTRUCTIONS AND DIVERSIONS

Name of Stream	Name of obstruction or diversion	Height in feet of dam or fall	Diversion (c.f.s.)
Imnaha River	Imnaha Falls	Total barrier	
Powder River	Duncan ditch) Oliver ditch)	6	30 30
Powder River	Basche ditch	3	40
Powder River	Miles ditch	3	15
Powder River	Thief Valley dam	70	
Powder River	Old Pioneer ditch	2	10
Powder River	Irrigation diversion	4	6
Powder River	Stewart-Shaw ditch	2	3 (max.12½)
Powder River	Smith Bros. ditch	3	12½ (max. 37½)
North Powder River	Irrigation diversion	1	2½
North Powder River	Irrigation diversion	2	4
North Powder River	Irrigation diversion	2	2
North Powder River	Big Bulger ditch	3	30
North Powder River	Big Mansfield ditch		20
North Powder River	Warfield-Burnside ditch		3-3/4
North Powder River	Little Mansfield ditch		7½

*This tabulation includes only those obstructions and diversions that would seriously interfere with runs of salmon and steelhead in the stream. No protective devices are present and none are recommended.

TABLE OF OBSTRUCTIONS AND DIVERSIONS

(Continued)

Name of Stream	Name of Obstruction or diversion	Height in feet of dam or fall	Diversion (c.f.s.)
North Powder River	Savage ditch	2	10
Burnt River	Old Division Lane	Low - no barrier	10.8
" "	Riber	" "	3.9
" "	Moore Bros.	" "	12.8
" "	Glen	" "	1
" "	Jervis	" "	2.6
" "	Chambeam	" "	6.4
" "	Banks	" "	9
" "	Wendt	" "	15.4
" "	Griffin	" "	5.8
" "	Norman Elliott	" "	19.6
" "	McPhearson	" "	6.4
" "	Clement	" "	8.0
" "	Old Mill	" "	6.6
" "	Otis Elliott-Cleary	" "	13.5
" "	Otis Elliott	" "	2.4
" "	Meadow	" "	4.0
" "	Clark's Creek	" "	7.3

TABLE OF OBSTRUCTIONS AND DIVERSIONS

(Continued)

Name of Stream	Name of obstruction or diversion	Height in feet of dams or fall	Diversion (c.f.s.
Burnt River	Hereford	Low - no barrier	5.5
" "	Packwood	" "	6.9
" "	Colt	" "	11.6
" "	Van Cleve	" "	4.2
Job Creek (trib. to Burnt R.)	6 irrigation diversions	" "	10.5 (total)
S.Fork, Burnt R.and tribs. (below Whited reservoir)	13 irrigation diversions	" "	50.0 (total)
South Fork,Burnt River	Whited reservoir	40	Not determined
South Fork,Burnt R.and tribs. (above Whited Reservoir)	12 irrigation diversions	Low - no barrier	80.0 (total)
Middle Fork, Burnt River	8 irrigation diversions	" "	6.0 (total)
West Fork, Burnt R.	2 irrigation diversions	" "	4.0 (total)
N.Fork,Burnt R.and tribs.	5 irrigation diversions	" "	36.0 (total)

LITERATURE CITED

EVERMANN, BARTON W.
1896. A preliminary report upon salmon investigations in Idaho in 1894 . . . U. S. Fish Comm., Bull., vol. 15, 1895(1896), pp. 253-284. Washington.

EVERMANN, BARTON W.
1897. A report upon salmon investigations in the headwaters of the Columbia River, in the State of Idaho, in 1895, together with notes upon the fishes observed in that state in 1894 and 1895 . . . . U. S. Fish Comm., Bull., vol. 16, 1896(1897), pp. 149-202. Washington.

EVERMANN, BARTON W., and MEEK, SETH E.
1898. Salmon investigations in the Columbia River Basin and elsewhere on the Pacific Coast in 1896 . . . . U. S. Fish Comm., Bull., vol. 17, 1897(1898), pp. 15-84. Washington.

HOBBS, DERISLEY F.
1937. Natural reproduction of quinnat salmon, brown and rainbow trout in certain New Zealand waters. New Zealand - Marine Dept., Fish. Bull. No. 6. pp. 1-104.

SHAPOVALOV, LEO and BERRIAN, WILLIAM.
1940. An experiment in hatching silver salmon (Oncorhynchus kisutch) eggs in gravel . . . . Trans. Amer. Fish. Soc., 1939(1940), vol. 69, pp. 135-140. Washington.

SMITH, OSGOOD R.
1940. Placer mining silt and its relation to salmon and trout on the Pacific Coast . . . . Trans. Amer. Fish. Soc., 1939(1940), vol. 69, pp. 225-230. Washington.

References such as "(U.S.G.S., 1940)" are to water supply papers of the U. S. Geological Survey. These papers are issued under the general title of "Surface Water Supply of the United States" and are issued in parts referring to various drainage basins. The papers referred to in this report are for Part 13, which covers the Snake River Basin. Dates given are dates of publication rather than the years to which the data apply.

Interior--Duplicating Section, Washington, D. C. 86315